MODERN PLASTICS

MAY 1961

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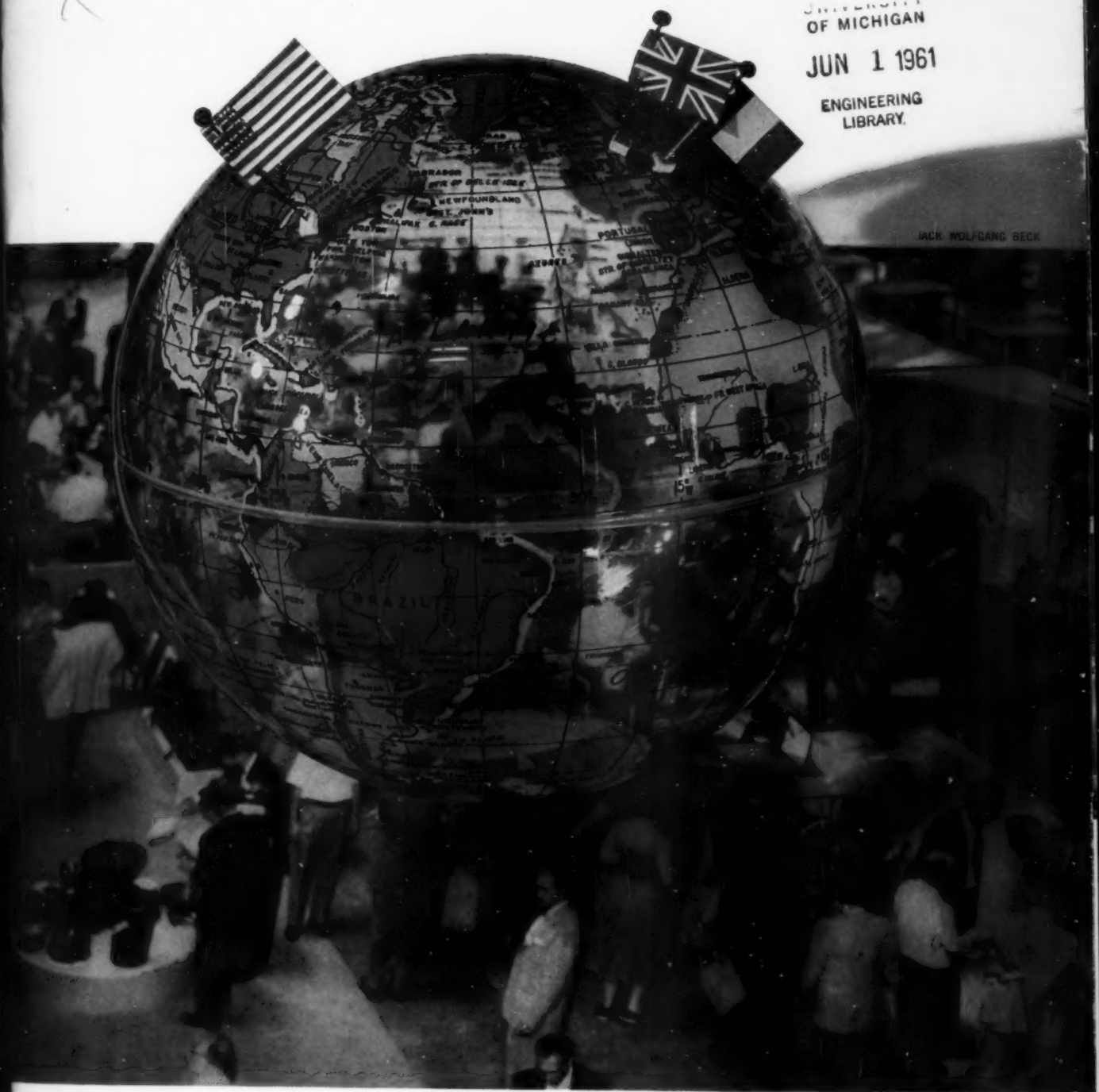

WIDE WORLD OF PLASTICS

Three major expositions point up international developments in materials...processing...applications

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p. 195 Guide to Europlastica 1961, Ghent, Belgium, June 16-25
p. 183 Guide to Interplas '61, London, England, June 21-July 1
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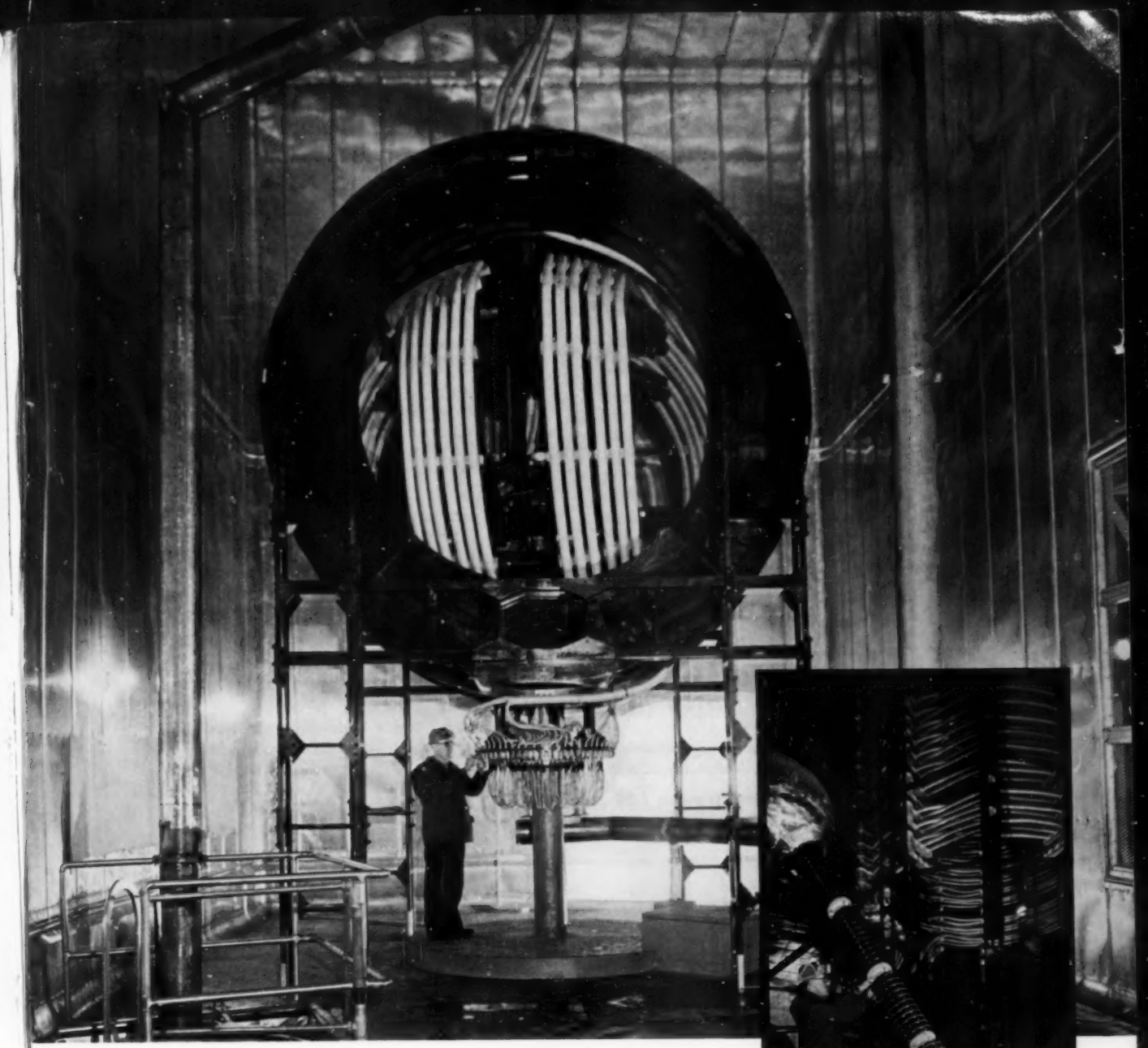

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MODERN PLASTICS*

Volume 38, Number 9 May 1961

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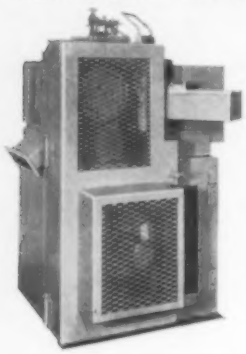

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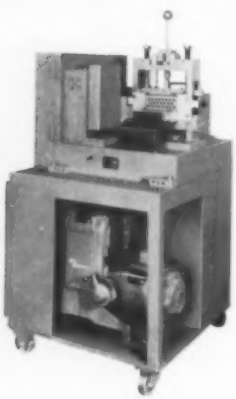

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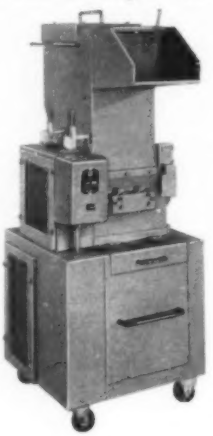

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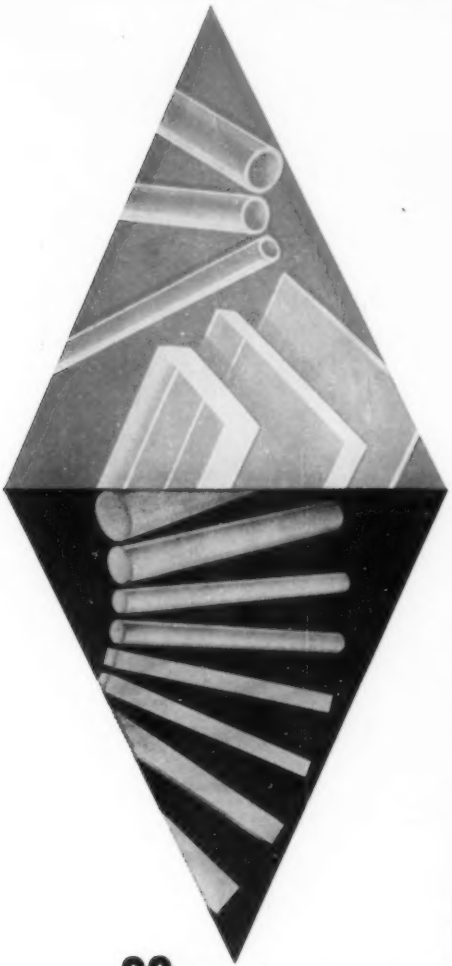

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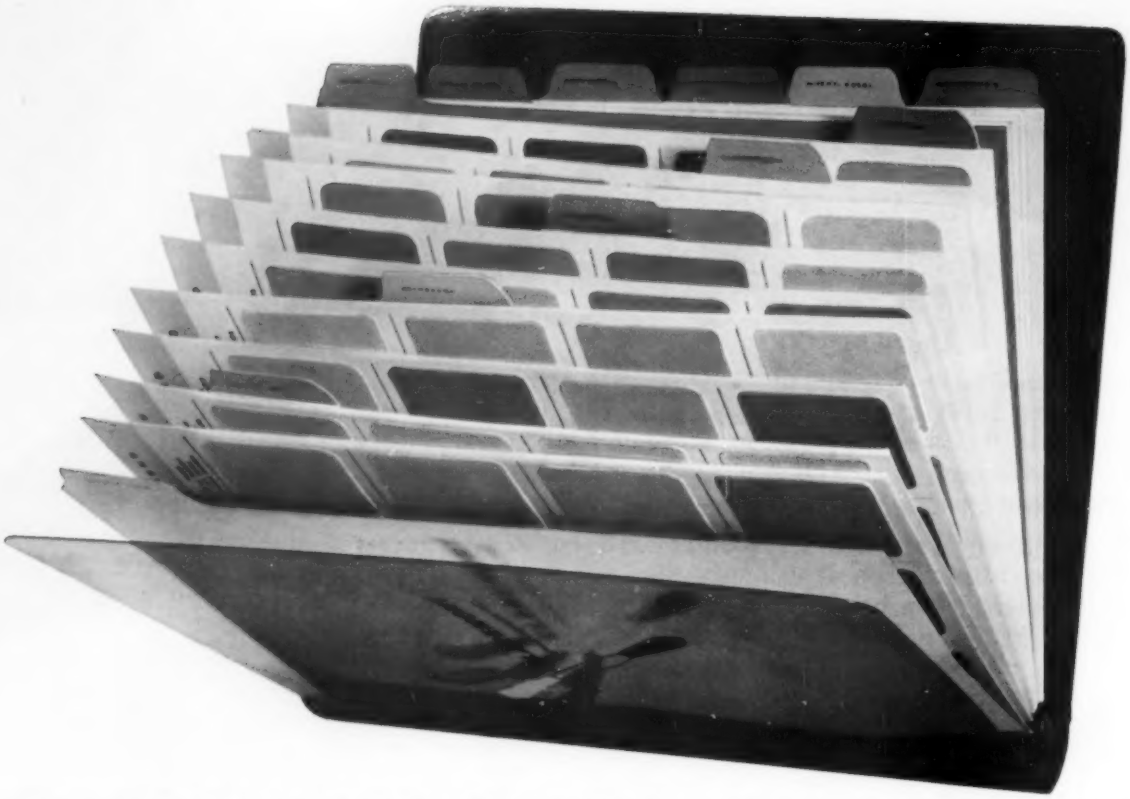

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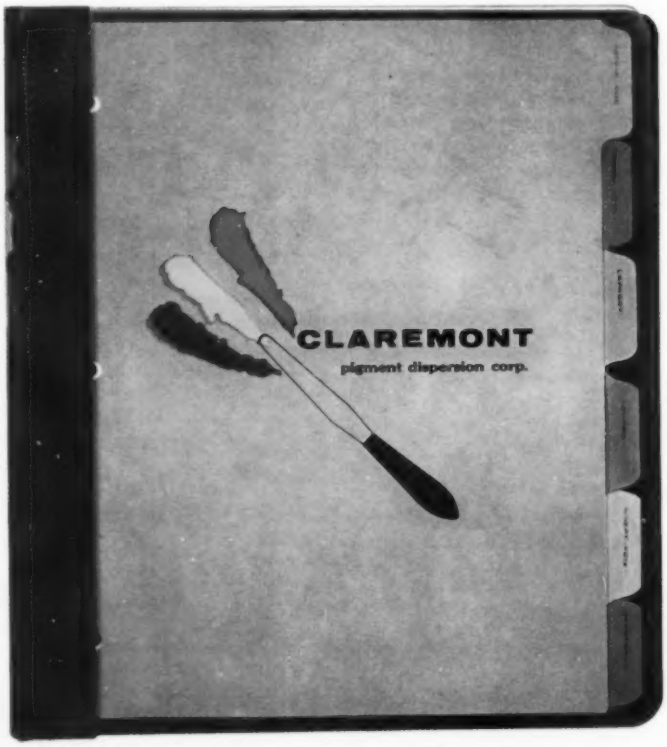

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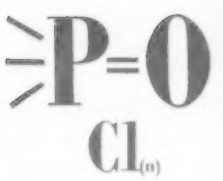

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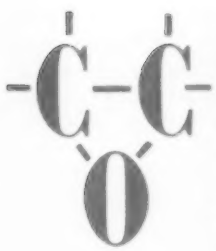

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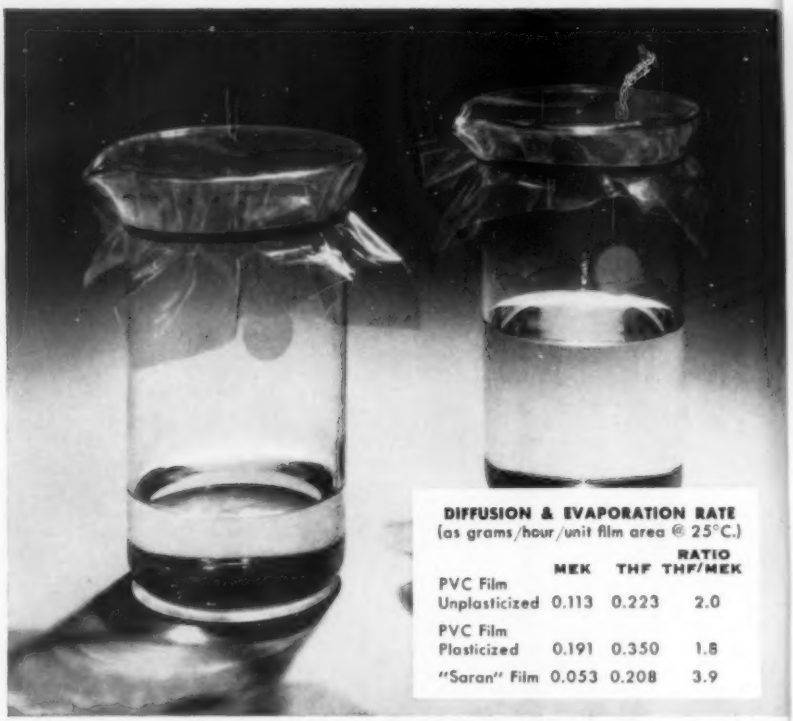

DIFFUSION & EVAPORATION RATE
(as grams/hour/unit film area @ 25°C.)

	MEK	THF	RATIO THF/MEK
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PVC Film Plasticized	0.191	0.350	1.8
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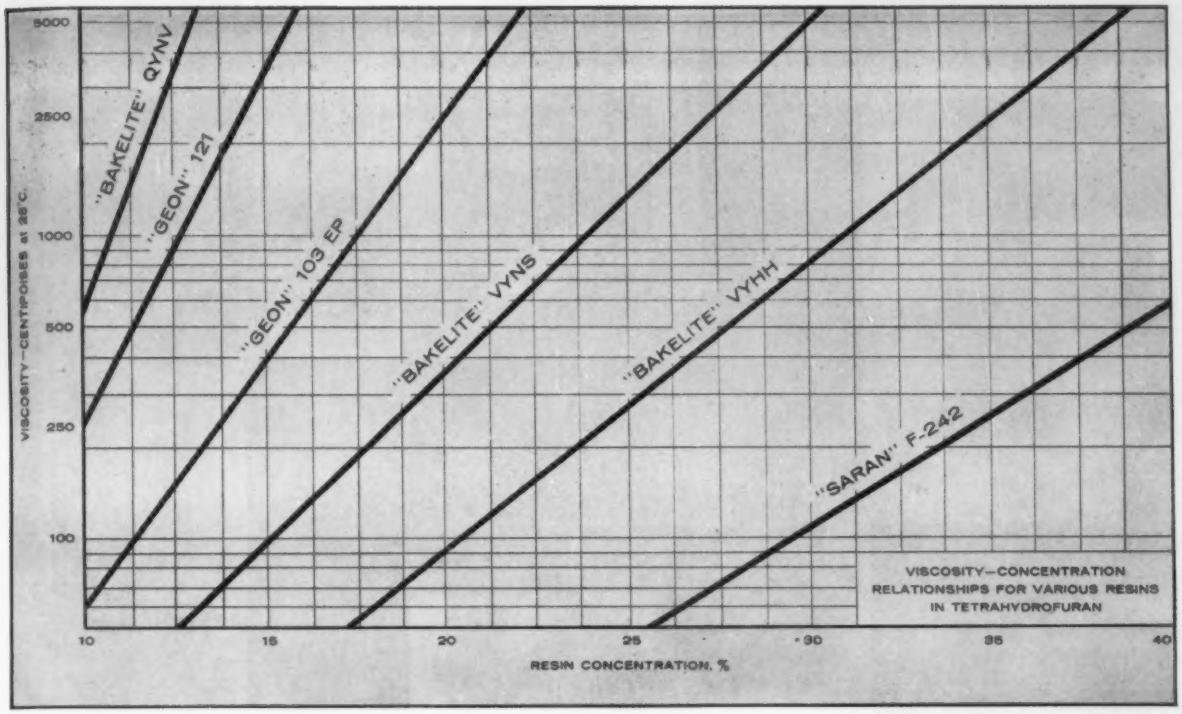

THF dissolves more PVC resin at room temperature than other solvents: The chart above shows the high percentage of various PVC resins which can be dissolved in tetrahydrofuran.

"Bakelite"—TM Union Carbide & Carbon Corp.
"Geon"—TM B. F. Goodrich Chem. Co.

vinyl product quality Tetrahydrofuran (THF)

THF IS EASILY RECOVERED

Up to 95% of tetrahydrofuran throughput can be recovered from coating, printing and film casting operations. Standard carbon adsorption units constructed of ordinary steel can be used to recover THF, whereas stainless steel equipment is necessary for recovery of many other solvents.

RESULT: *You are assured of minimum solvent loss—low recovery cost. Most existing systems can be modified easily and economically to recover THF.*

THF PROPERTIES

Appearance	Colorless, mobile liquid		
Odor	Etherlike		
Molecular weight	72.10		
Freezing point	-108.52°C.		
Boiling range	65°-67°C.		
Specific gravity (20°/4°C.)	0.888		
Weight, lb./gal. (20°C.)	7.4		
Flash point (Tag closed cup)	6°F.		
Vapor pressure, mm Hg. at:			
15°C	114	45°C	385
25°C	176	55°C	550
35°C	263	65°C	760
Surface tension, dynes/cm. (25°C.)	26.4		
Solubility	Miscible with water, soluble in most organic solvents		

Learn more about THF . . . how its unique combination of useful properties can help improve the quality of your vinyl products. Send for your copy of new THF booklet, "Properties and Uses of THF". Just drop a line to Du Pont at the address below:

E. I. DU PONT DE NEMOURS & CO. (INC.)
ELECTROCHEMICALS DEPARTMENT
CHLORINE PRODUCTS DIVISION
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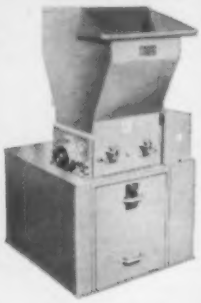
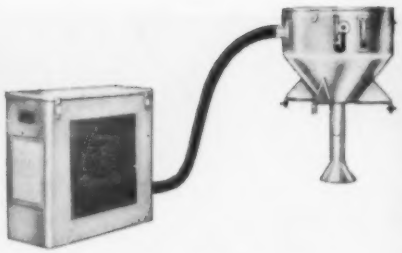
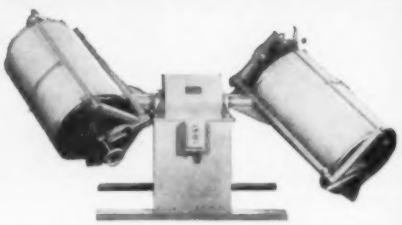


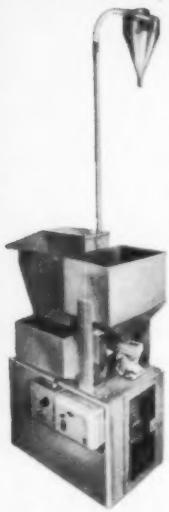
MARVEL SERIES GRANULATORS
Models with capacities from 75 to 500 pounds an hour. Constructed of steel.



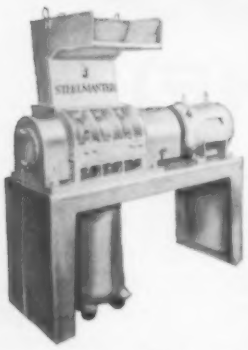
HEATER-DRYER (HOPPER ATTACHMENT)
Disperses moisture and preconditions material. Helps eliminate rejects and increase production. Steel or stainless steel construction.



TUMBLEMASTER DRUM TUMBLERS
Floor level loading. Accommodates 28" to 37" drums. Ball bearing equipped. Extra heavy steel construction throughout.



BLENDOMATIC GRANULATORS
Mix virgin material with regrind as the regrind is generated, then load mixed material into extruder or molding machine hopper.



STEELMASTER GRANULATOR
Makes the toughest grinding jobs easy. Heavy steel plate construction throughout.

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Compare construction. Compare performance. Compare initial cost. Compare operating cost. Dollar for dollar, you'll find that a B & J machine gives you more. Write for illustrated brochures and prices.

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The quietest operating pelletizers on the market. Make uniform pellets from any thermoplastic. Extra rugged steel construction.

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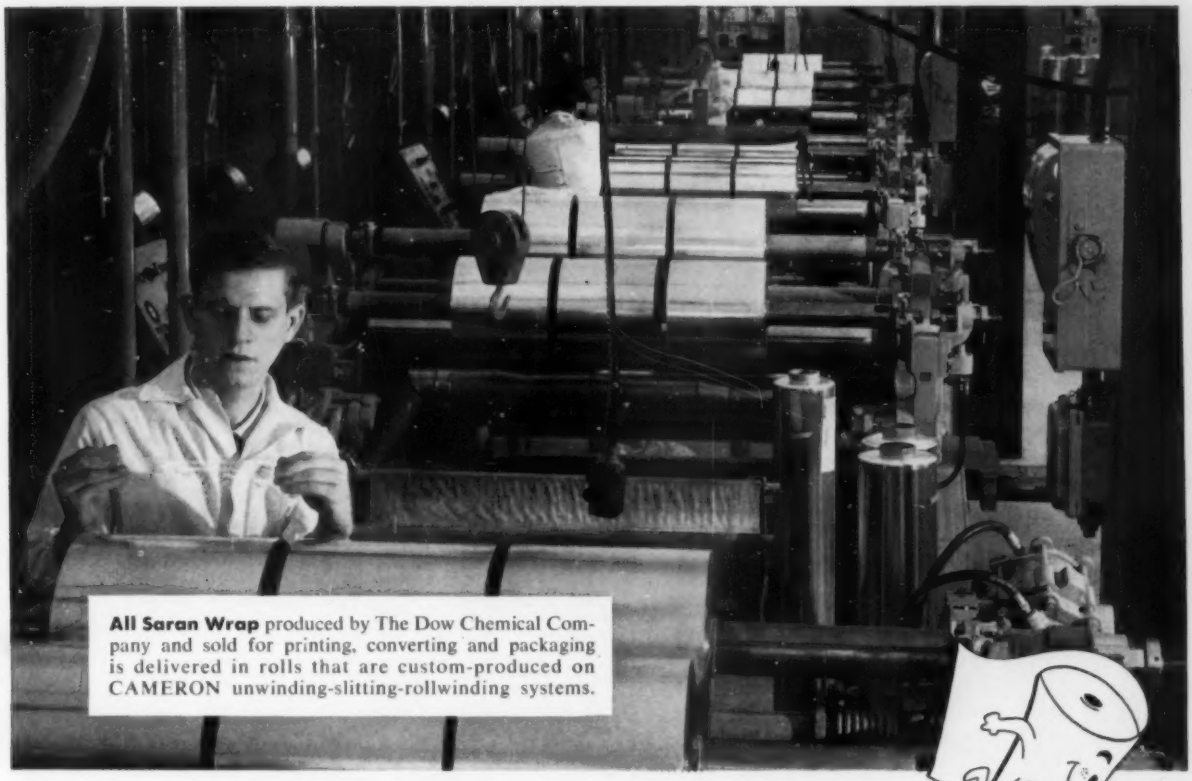


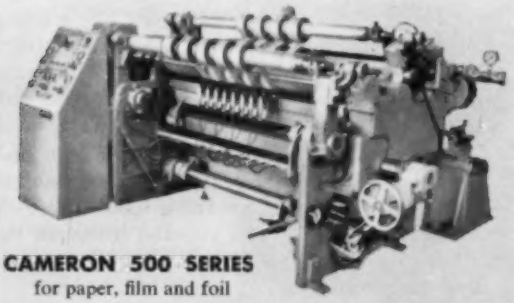
All Saran Wrap produced by The Dow Chemical Company and sold for printing, converting and packaging is delivered in rolls that are custom-produced on CAMERON unwinding-slitting-rollwinding systems.

Saran Wrap* *delivers the superb running qualities of* The New Roll

Every roll of commercial Saran Wrap is custom-made with extreme care to assure trouble-free feeding to high speed, long run printing and converting operations. The fine *running quality* of Saran Wrap rolls is protected by *integrated roll control*, engineered by Cameron specialists.

Among the Cameron equipment in use at Dow's Saran Wrap Plant in Midland, Michigan are numerous Cameron 502 integrated roll production systems. These Cameron 502's produce feed rolls of one-half mil Saran Wrap at 1000 fpm, running 24 hours a day, seven days a week.

*"Saran Wrap" is a trade mark of The Dow Chemical Company.



CAMERON 500 SERIES
for paper, film and foil
Speeds to 2000 fpm. Roll dia. to 20". Widths to 62"
Changeover slitting from score to shear to razor cut.

Roll control on the Cameron 502 starts with an integrated shaftless unwind equipped with an eddy current brake to provide highly sensitive automatic constant tension. Other roll control features of the 502 system include: the use of eddy current couplings for individual speed control on the main drive and on each of the separate rewind shaft drives; and air-loading of rewind core friction to precise pressure settings. Core friction works in combination with pneumatic down-pressure control and automatic rewind counterbalance to eliminate guesswork in rewind contact pressure and roll density. The result is a finished roll of superb running quality —The New Roll.

How you can produce The New Roll. Let us test-run your material (paper, film, foil, laminates, etc.) on an integrated, job-fitted pilot unwinding-slitting-rewinding system at our Research and Development Service in Dover, N. J. Write for information.

AA-388

CAMERON
a team of specialists

Cameron Machine Company, Franklin Road, Dover, N. J.
Canada: Cameron Machine Co. of Canada, Ltd., 14 Strachan Ave., Toronto, Ont.
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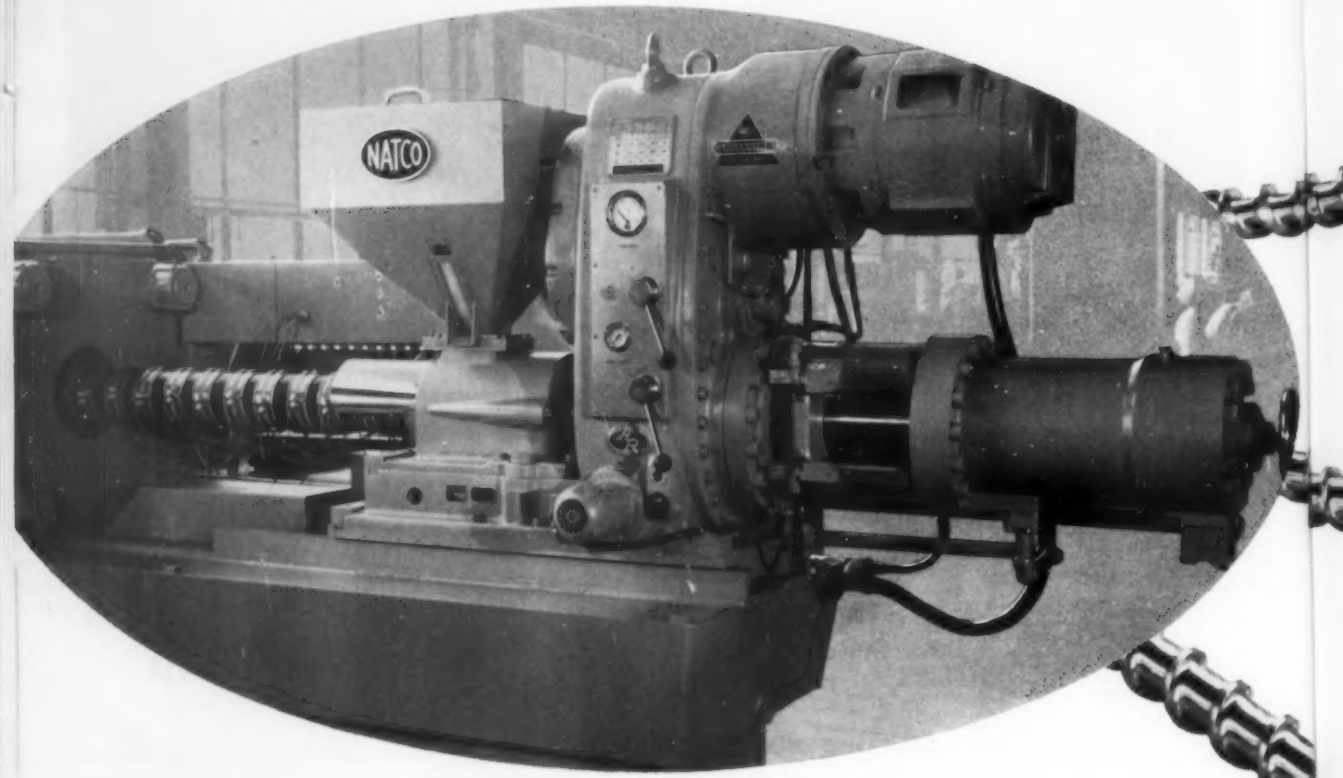
famous TIDLAND pneumatic shafts are sold exclusively through Cameron

55 years devoted exclusively to the design and manufacture of slitting, roll winding, unwind and web control equipment.

NATCO announces



Natco's new reciprocating screw machines provide the injection molder with the most efficient preplasticizing method yet developed! The Natco extruder method of melting and molding resins offers you many money saving advantages:

1. Faster molding cycles
2. Quick color change
3. High melt capacity
4. Easy material change
5. Homogeneous plastification
6. Ideal plastic flow
7. Lower stock temperatures
8. Excellent dry coloring
9. Better molded physicals
10. Shockless hydraulic circuit

Natco "Screw-Ram" molding is far superior to conventional preplasticizing methods using "piggy back" heating chambers. Money saved by this new extruder method on material and color changes alone will pay for these new machines! Imagine making tough color or material changes in ten shots or less! That's saving money fast.

Regardless of shot size or material used, the screw will melt resin as fast as you can mold it. Now, with Natco Screw-Ram, cooling the material in the mold is the only cycle limitation! It's a recognized fact that hard flow and heat sensitive materials are faster and more ideally plasticized by the extrusion process. Injection pressure drop and the problems caused by laminar flow have been eliminated!

All of the high speed dependable features which have made Natco injection machines famous have been incorporated into these new "Screw-Ram" machines. Natco offers you the injection machine of the future . . . available in 1961. Write today for more information.

NATCO
SCREW-RAM

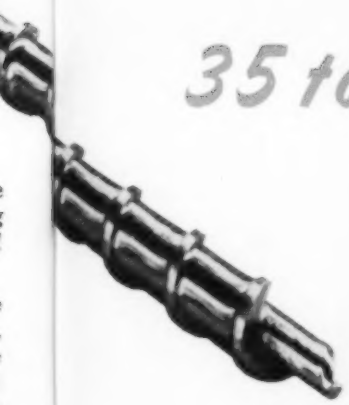
NATIONAL AUTOMATIC TOOL COMPANY, INC.
PLASTICS MACHINERY DIVISION
RICHMOND, INDIANA, U. S. A.

SCREW-RAM

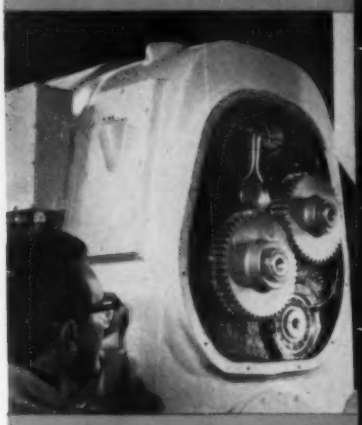
preplasticizing

22 Stock Models

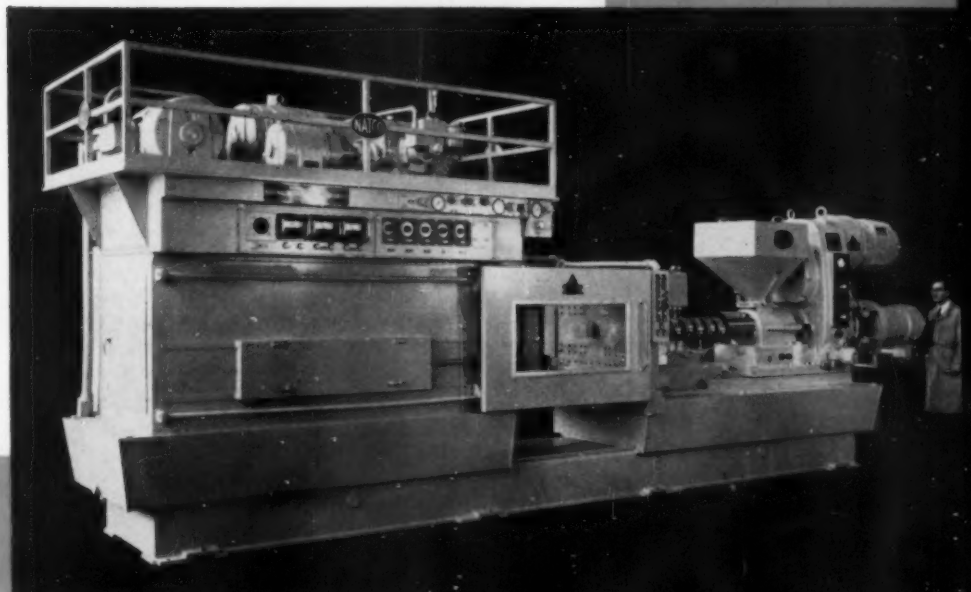
35 to 140 Ounces



Heavy duty, high torque gear reducer with quick four speed selection of optimum screw speed. Direct electric motor drive through flexible coupling and clutch.



Three sets of change gears provide twelve screw speed selections. All plastic materials can be melted at maximum output with the highest efficiency of the drive motor.



Natco Model 400-E

60 Ounce Screw-Ram Unit
Melt Capacity—330 lbs./hr.
Mold Clamp Force—425 Tons
Mold Platens—38″ x 38″
Maximum Daylight—62″
Clamp Stroke—26″ or 36″
Inj. Rate—21 or 44 cu. in./sec.

THE MOLDER'S MOLDING MACHINE

THAT EXTRA TOUCH OF GRACE: Market Development

Whether it's your new product idea or ours, it always sounds great at first blush. To be sure it is, Grace will check it out (in the strictest confidence) with jobbers, buyers and consumers. This program to develop new saleable end uses for modern thermoplastics is one of the 10 major services available to Grace customers as part of the Grace Service Plan. To the many manufacturers who have successfully used this service, it is one more proved example of that extra touch of Grace.

W. R. GRACE & CO. POLYMER CHEMICALS DIVISION, CLIFTON, N. J.

HIGH DENSITY POLYETHYLENE, LOW AND MEDIUM DENSITY POLYETHYLENES, POLYSTYRENES.

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GERING—first choice for quality products at definite savings

Get specific end-colors every time with

DRYCOL

Thoroughly Compounded DRY COLORANT for One-step, In-plant Coloring of All Thermoplastics

No doubt about the batch! That's the beauty of using pre-measured Drycol — a thoroughly formulated dry colorant that delivers specific end-colors every time! What's more, with Drycol you have the flexibility of colors galore without having to store! And no top-heavy inventory of colors means you can also get the volume discounts that go with buying bulk orders of thermoplastics in natural.

"DRYCOL" is conveniently packaged in pre-weighed units for ready blending with all thermoplastics. It is also supplied in bulk to give the molder greater savings and added flexibility in production scheduling.

Write for the full story on Gering's "DRYCOL" — it'll pay you time and again.

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Kenilworth, N. J.

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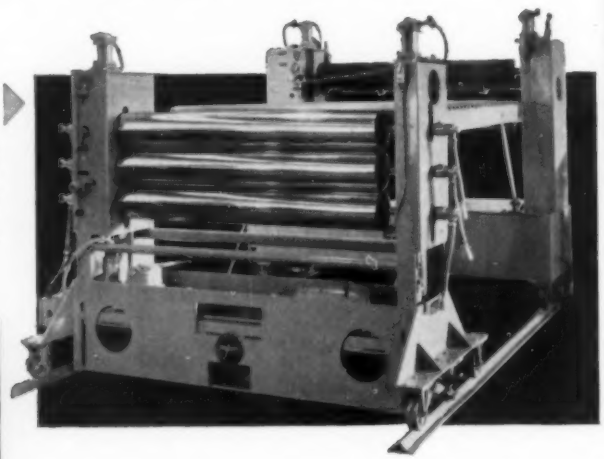
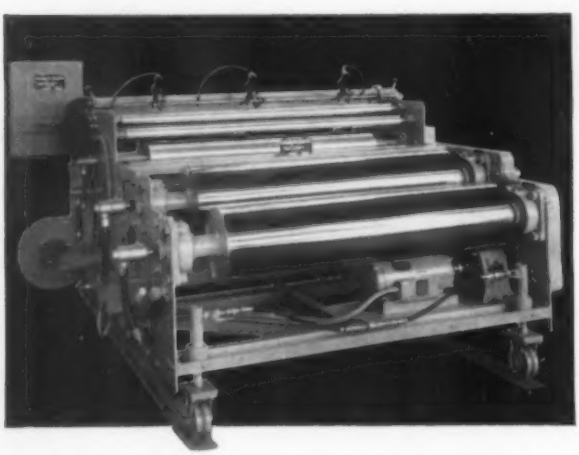
These exciting new MPM ideas and features give you the finest in Thermoplastic Processing Equipment

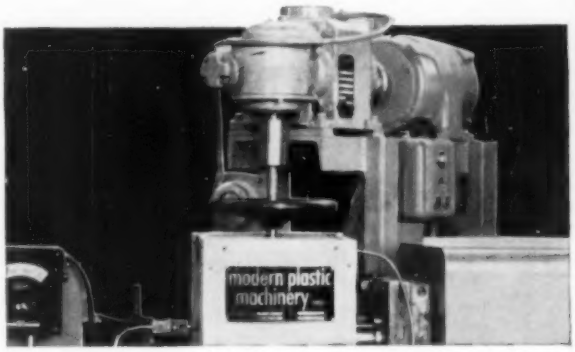
NOW EMBOSS RIGID STYRENE AND OTHER RESINS... for such products as lighting and decorative panels, new heavy sheet embossing equipment now makes casting dies for this purpose old fashioned. It's an exclusive new concept for the continuous production of any design on any standard width of rigid styrene. A complete line of MPM equipment is available for sheet embossing, from the extruder to the finished sheet.





FOR FILM AND SHEET PRODUCTION... from polypropylene, PVC and polyethylene, MPM's equipment is as up-to-date as tomorrow. MPM's patented "coat hanger" die provides uniform distribution of pressure and flow over the entire width of the film. Double shell roll construction with high velocity water flow assures a uniform temperature to produce high quality film. Roll surfaces are mirror polished to obtain the finest roll and film quality. The precise speed and tension control of our take-up units results in exceptionally uniform winding.

NEW DIE HEAD IMPROVES MONOFILAMENT PRODUCTION ... MPM's improved pump-type die insures uniform pressure, preventing breaking and uneven diameters. You're assured of constant, unvarying output and pressure regardless of pressure variations within the extruder itself. Complete monofilament lines, including extruder, dies, quench tank, godet units, drawing ovens and spoolers, are available from MPM.



For more information on these and other MPM machinery, write for our new 16-page illustrated catalog and specifications sheets.

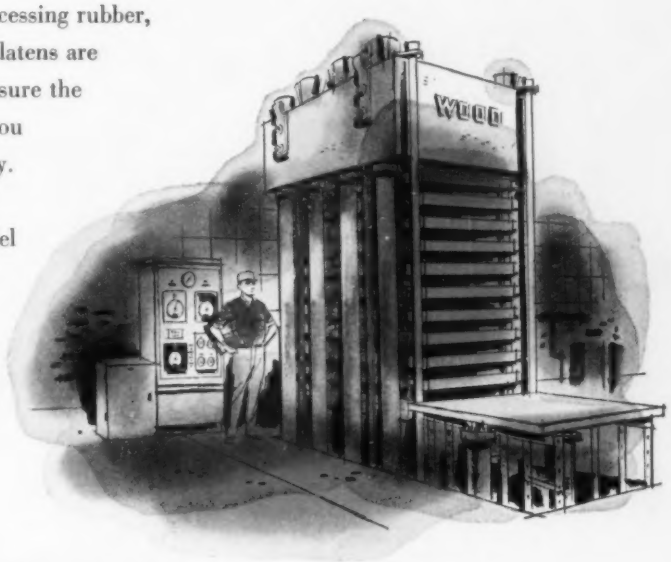
Modern Plastic Machinery Corp.

General offices and engineering laboratories: 64 Lakeview Avenue, Clifton, N. J.

R. D. Wood heating platens...

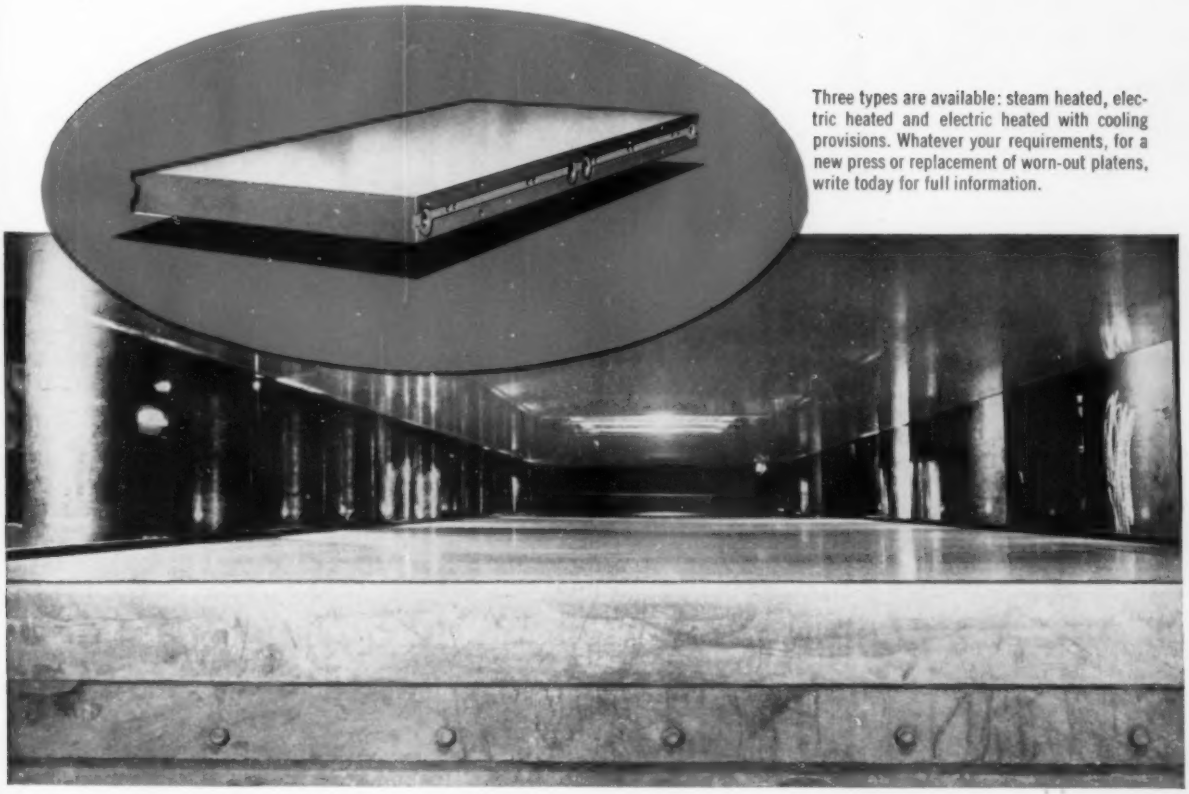
precision-engineered to give you superior finished products

Here's the perfect working surface for processing rubber, plastics and wood products. R. D. Wood platens are carefully designed and manufactured to assure the highest-grade surface finish. With them, you produce top quality products—consistently. They are made from especially processed rolled steel slabs, machined to close parallel tolerances and drilled with extreme accuracy on evenly spaced centers to insure equal heat distribution throughout the platen. Here is precision. Perfect for your new press. Perfect for replacement on existing presses. Perfect for more value, longer life.



R. D. WOOD COMPANY

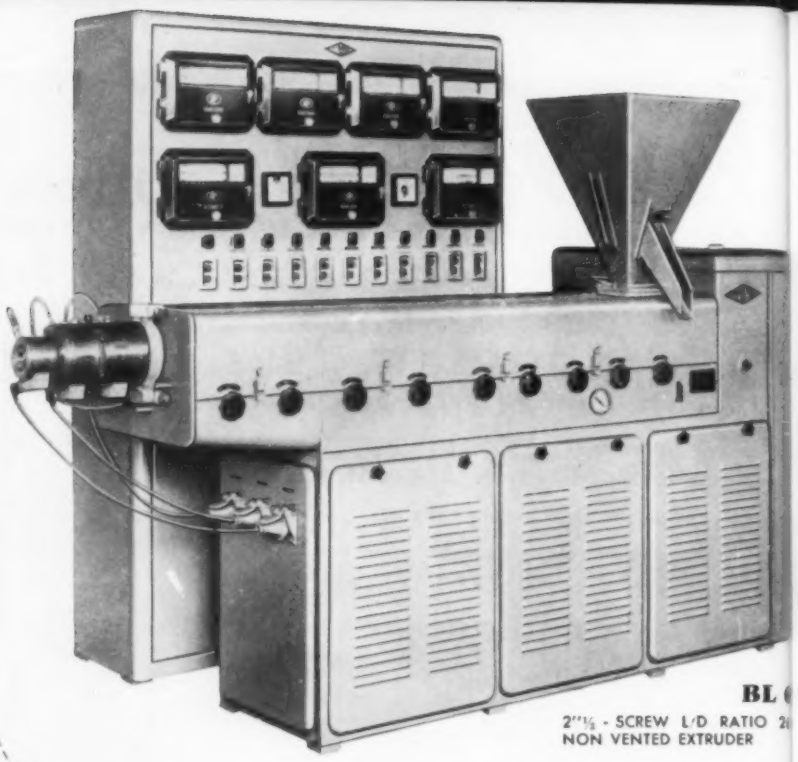
PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA



Three types are available: steam heated, electric heated and electric heated with cooling provisions. Whatever your requirements, for a new press or replacement of worn-out platens, write today for full information.

for wonderful productivity!

FOR ALL TYPES OF PLASTICS



BL (
2"½ - SCREW L/D RATIO 2(
NON VENTED EXTRUDER

We exhibit at the
Plastics International Exhibition
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BLOW MOULDING PLANTS

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REPRESENTATIVES IN EVERY COUNTRY

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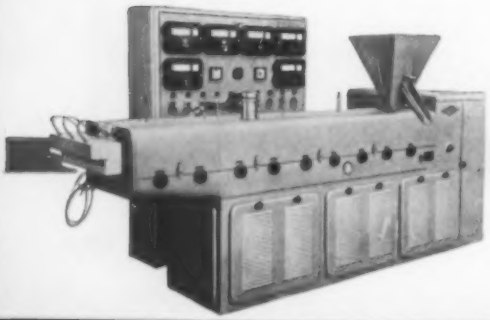
BG 90
3"½ - SCREW L/D RATIO 26:1
VENTED EXTRUDER



SAMAFOR EXTRUDERS ARE AVAILABLE IN SCREW SIZES OF 1 1/4"- 1 3/4"- 2 1/2"- 3 1/2"- 4 3/4"- 6" - WITH L/D RATIOS OF 20:1 OR 26:1 - AND VENTED OR NON VENTED CYLINDER

TECHNICAL DATA

Screw diameter between 30 and 150 mm (1" 1/4 and 6")
L/D Ratio : Non vented type : 20:1 - 26:1
Vented type : 26:1 only

REDUCTION GEAR : Horizontal double gear train - helicoid gear cut, allowing smooth running and high working speeds.

FEED SECTION : Cooled by adjustable water flow.

BARREL : One piece made - Nitrided steel - heating by shrouded resistances placed in grooves perpendicular to the barrel generatrix. Cooling by air with manual adjustment. Temperature regulation controlled through a proportioning type heater.

SCREW :
Chromium molybdenum steel - Stellited flight lands - Hard chromium plated flight and flight sides - Cooling by oil flow, regulated within ±2° C. accuracy - Screw types for various materials processing Quick disassembly by front barrel.

HEADS : For all purposes : profiles, tubing, pipes, sheets, tubular film, blow moulding, bottles, bands, etc...
Heads fixed to barrel. by clamp.

REGULATION AND CONTROL CABINET.
Containing the temperature regulators, the motors and heating device contactors. Are fixed on a panel, mounted on shock absorbers for vibrations protection.

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FRANCE
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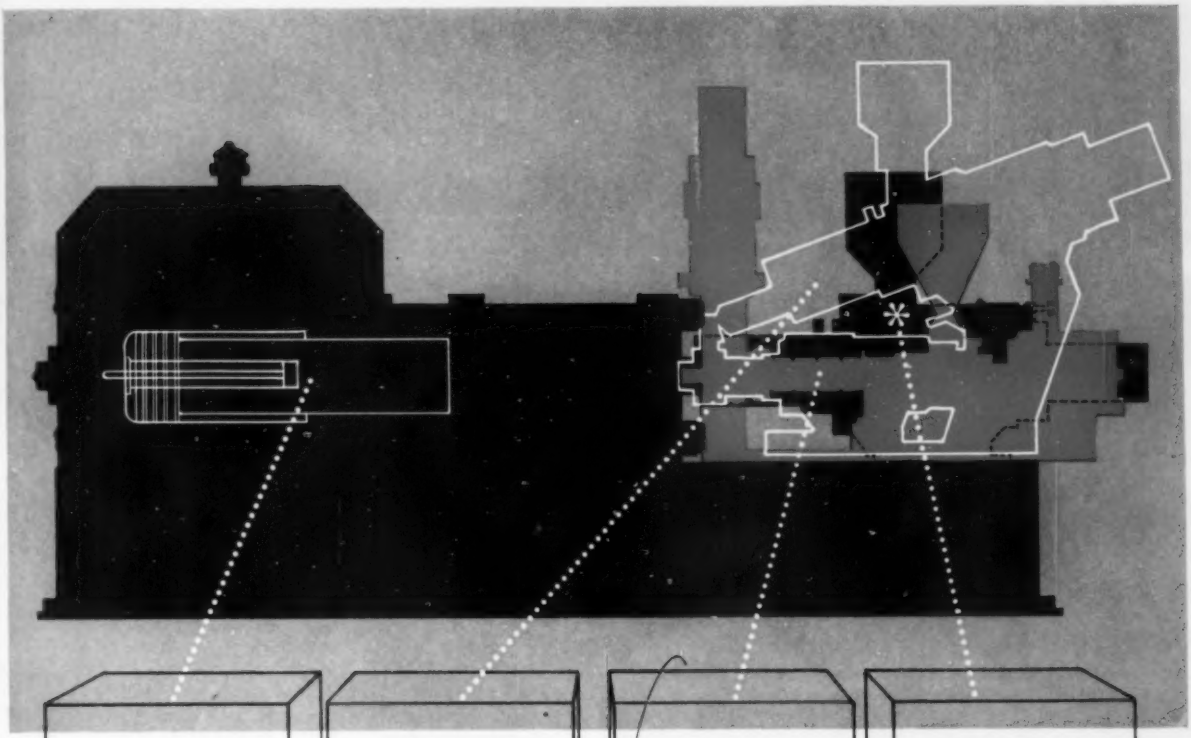
SAMAFOR

Cut your machine costs with economical H-P-M building block units



CLAMP TONNAGE
200, 350
450, 650
1000, 1500
2500

TWO-STAGE PLUNGER TYPE PREPLASTICIZERS
(OUNCES MATERIAL PER CYCLE)
28, 80,
140, 200, 300

SINGLE- OR TWO-STAGE SCREW TYPE PREPLASTICIZERS

CONVENTIONAL PLUNGER TYPE INJECTION
(OUNCES MATERIAL PER CYCLE)
6/8, 12/16, 24/30,
32/42, 48/64,
80/100

Unit construction of H-P-M injection machines permits almost unlimited arrangements, "custom-built" to meet your specific needs. With interchangeable units you can select a machine to fit your requirements as if it were specially built for the job. This is possible because of the wide range of tonnages, injection capacities, and types of injection, listed above. Contact us today — we can save you money.

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BOOTH 320

Don't miss
9th National
Plastics Exposition
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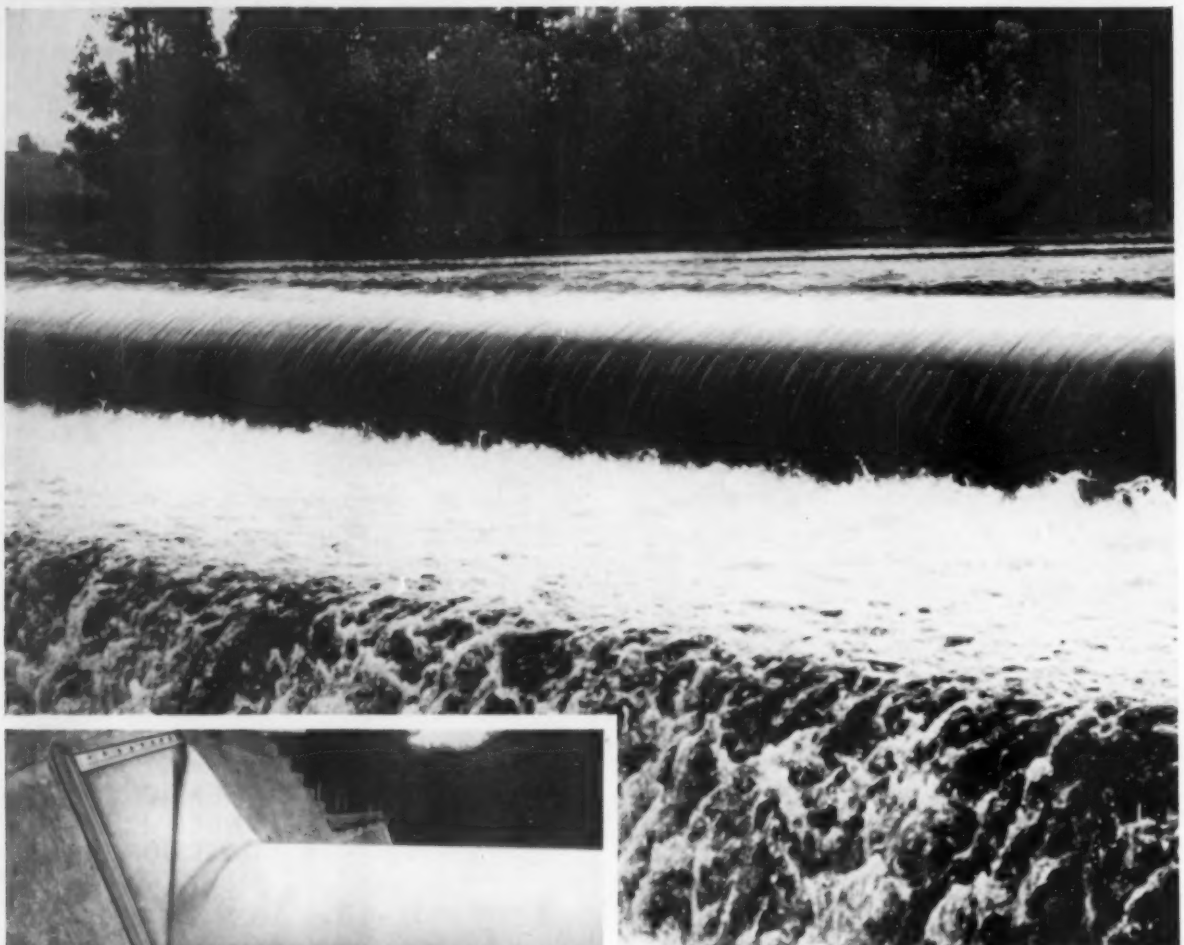
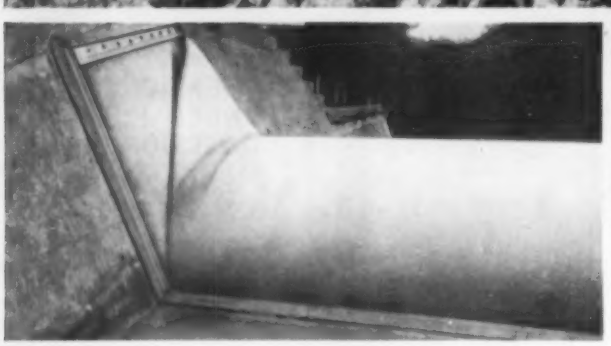
H-P-M DIVISION
Koehring Company
Mt. Gilead, Ohio, U.S.A.

HPM H105

Revolutionary fabric dam inflates, deflates to control flow of water





Left: view of one end of inflated Waialua Fabridam before rains raised reservoir level. Easily installed on concrete foundation.

Above: water flows over Fabridam, from Wahiawa Reservoir into tunnel leading to plantation, at rate of 175 million gallons per day.

Irrigating the ten thousand acres of sugar cane under cultivation by the Waialua Agricultural Company, Ltd., of Waialua, Hawaii, takes more than 25 billion gallons of water a year. To conserve extra water available during wet periods, a remarkable new "Imbertson Fabridam by Firestone" was installed in the spillway of the Wahiawa Reservoir.

Far less costly than conventional control gates, this light, flexible fabric dam increases the storage capacity of the reservoir by 500 million gallons. During the rainy season, it automatically deflates sufficiently to prevent flooding.

Wellington Sears supplied the nylon base fabric used by the Coated Fabrics Division of The Firestone Tire & Rubber Company for the Fabridam. With a tough neoprene coating, it has outstanding resistance to deterioration from age and abrasion—for a life expectancy of 15 years.

This is but another demanding use which Wellington Sears fabrics serve. We have wide experience in engineering cotton and synthetic fabrics to specific jobs—and are always ready with sound technical assistance. For a copy of our illustrated booklet, "Fabrics Plus," write Dept. K-5.

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FIRST in Fabrics for Industry

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Modern Magic!

PRESTO®
PLENCO

WIZARDRY WITH **PHENOLIC MOLDING COMPOUNDS** FOR HANDLING "WORKING STEAM"

This is the new *Steam-Dry* Iron whose "working fingers of steam" issue from 21 vents to smooth away wrinkles fast. It's made by National Presto Industries, Inc., Eau Claire, Wis. Although its ironing surface is extra large and its tank holds up to 30% more water, the Presto iron is surprisingly light in weight. A woman can maneuver it with aplomb—and with perfect safety.

Pardon us if we take a bow at this point—for Plenco phenolics. For the iron's stay-cool handle, control housings, and body are all incorporated into a handsome, one-piece assembly molded with Plenco 466. This special-purpose molding compound meets every Presto test for heat resistance, insulating properties, dimensional stability, durability, and is made to weather steam-ironing conditions of 100% humidity.

Plenco 466 is one of many excellent Plenco phenolic molding compounds available . . . general- as well as special-purpose, ready-made as well as custom-formulated. Our technical counsel and practical experience is also available, always. You've only to call.

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PLASTICS ENGINEERING COMPANY
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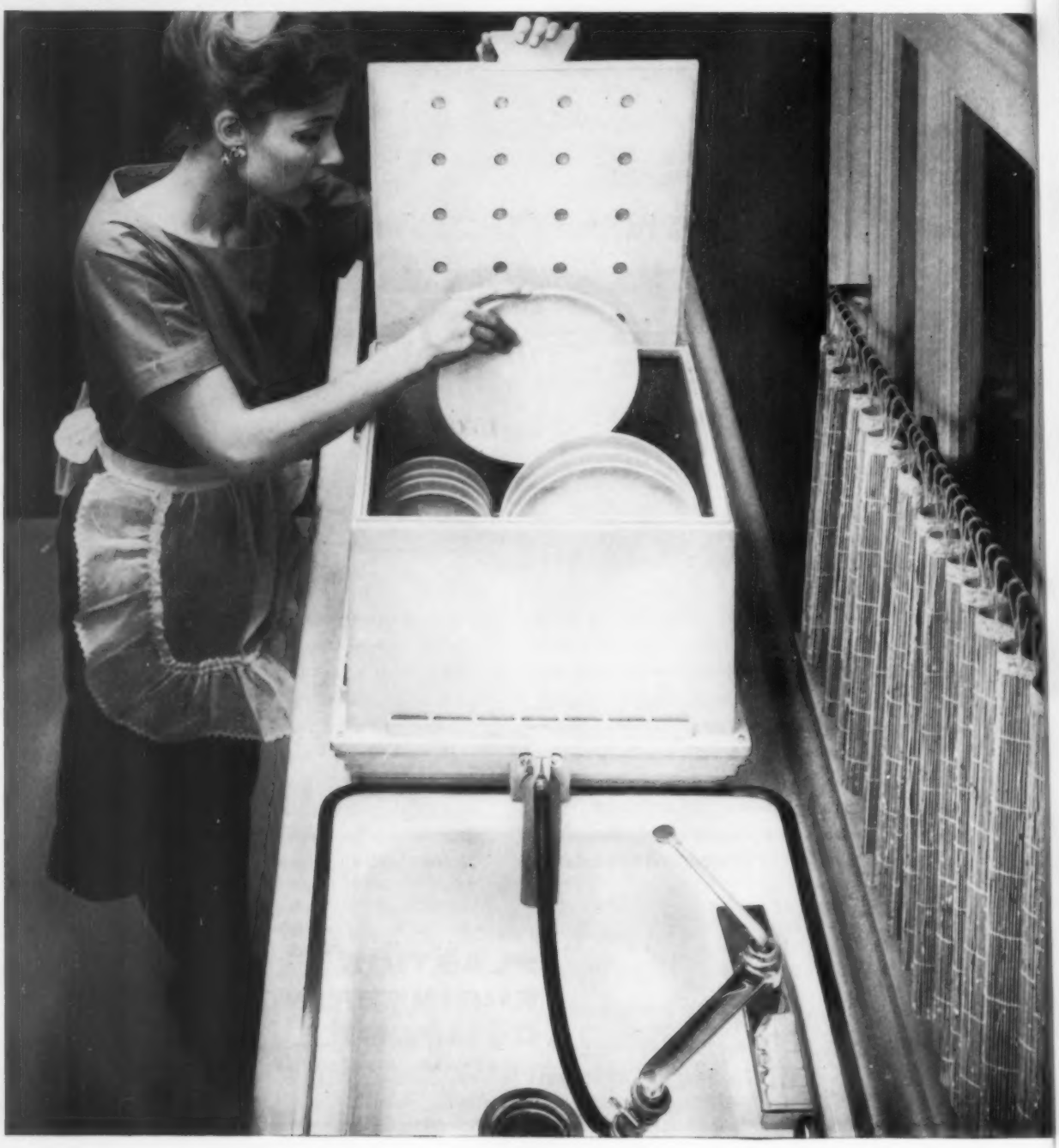
Portable dishwasher powered by kitchen tap

This 11-pound, portable dishwasher developed by Spaulding Industries, Inc., Chicago, Illinois, needs no power other than water pressure from a tap. Just set it on the sink, attach its hose to a faucet, and turn on the water. It washes and rinses completely in only 6-8 minutes.

The base, case and lid are molded from heat-resistant, high-impact DYLENE® polystyrene. The one-piece DYLENE base and lid have intricately molded vents that circulate cool air that dries dishes in a matter of minutes. DYLENE plastic is easy to mold in any permanent color, size or design. It won't flake, chip, peel or mar surfaces, and it's unaffected by harsh detergents and scalding hot water.



Foam plastic liner muffles disposer noises

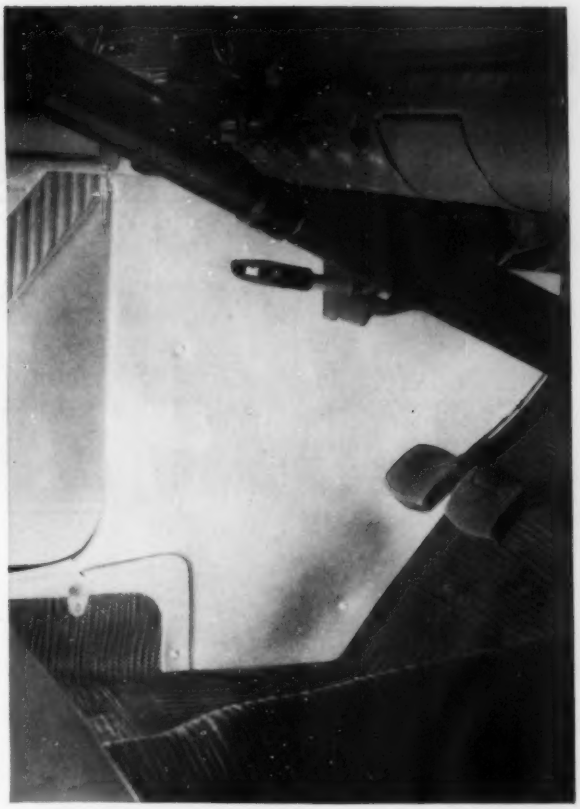
Designers at In-Sink-Erator Manufacturing Company knew they could increase sales of this new Gold Comet garbage disposer if they could make it work quieter. So they placed a molded liner of DYLITE® expandable polystyrene inside the unit. This rigid foam plastic muffles noises as the unit shreds food wastes down the kitchen drain.

DYLITE is strong, lightweight, water and vapor-resistant. It can be molded to almost any size, shape or color. This low-cost plastic is ideally suited for a wide variety of applications in protective packaging, low temperature insulation, flotation and refrigeration. DYLITE parts molded by: Stevens Plastics Products, Hebron, Illinois.

Trash cans that won't rust, rattle or corrode

Because it's polyethylene, these trash cans resist acids, alkalies, rust and corrosion, and even rough handling won't dent, chip or peel them. They're molded from durable DYLAN® polyethylene and available in beautiful permanent colors. Each trash can has a molded lid that locks tight and prevents spilling.

Koppers has a wide range of polyethylenes for almost any application. They are available in densities ranging from .914 to .953 gm./ml. By varying density, molders or design engineers can get varying degrees of stiffness, heat distortion and tensile strength. Trash cans molded for Sears Roebuck by G. A. T. X., Chicago, Illinois.



Plastic side cowls protect car interiors

Ford Motor Company now uses SUPER DYLAN® high-density polyethylene for interior side cowls on all their Falcon, Comet, Mercury, Thunderbird and Ford models. These cowls have replaced painted hardboard and fabric lacing. They last longer, look better, install easier.

SUPER DYLAN side cowls won't scuff, crack, chip or peel. They won't absorb water so they don't warp or discolor. Temperature changes won't bother them. They're easy to clean and their colors are built-in to last the life of the car.

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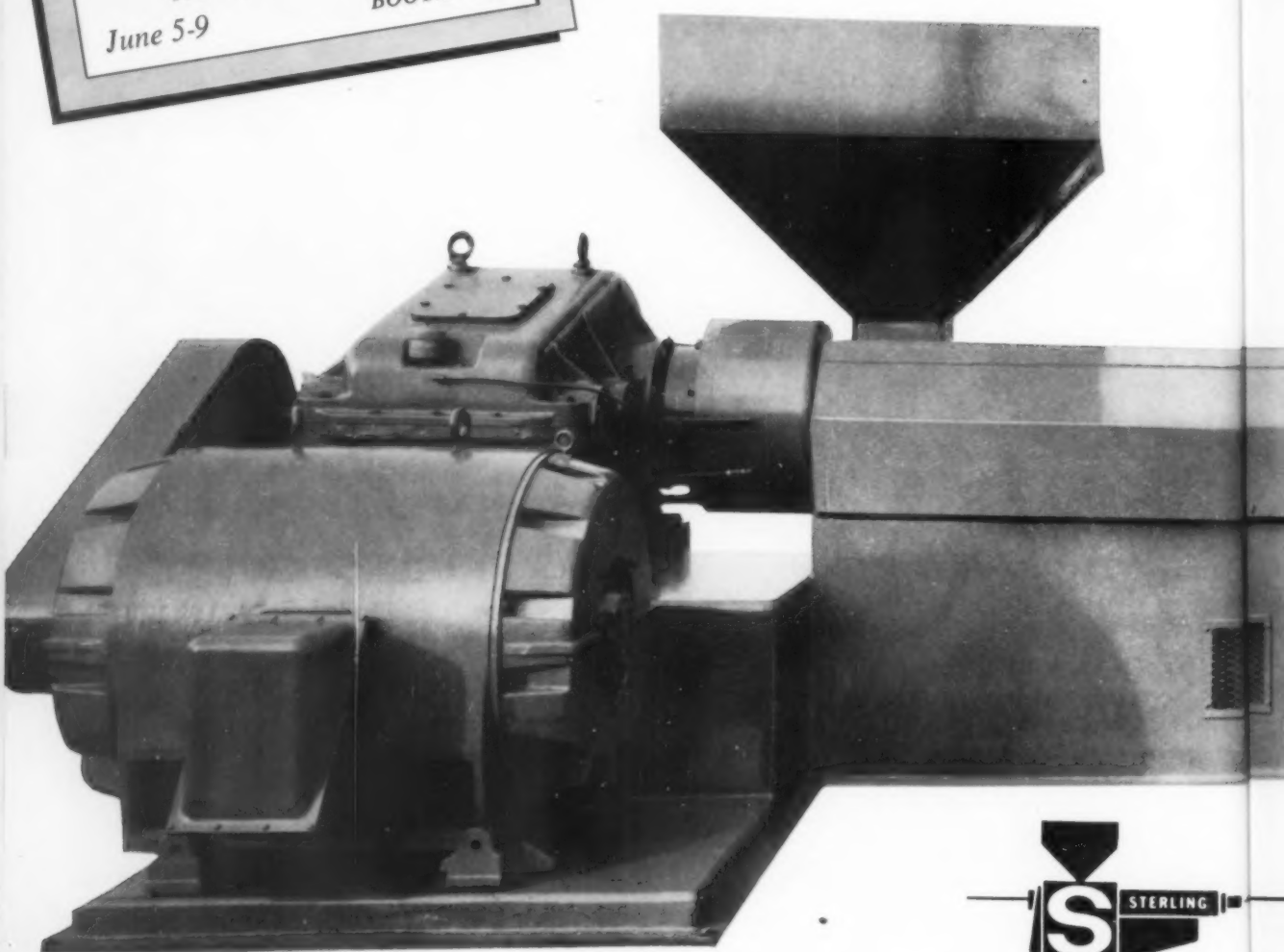

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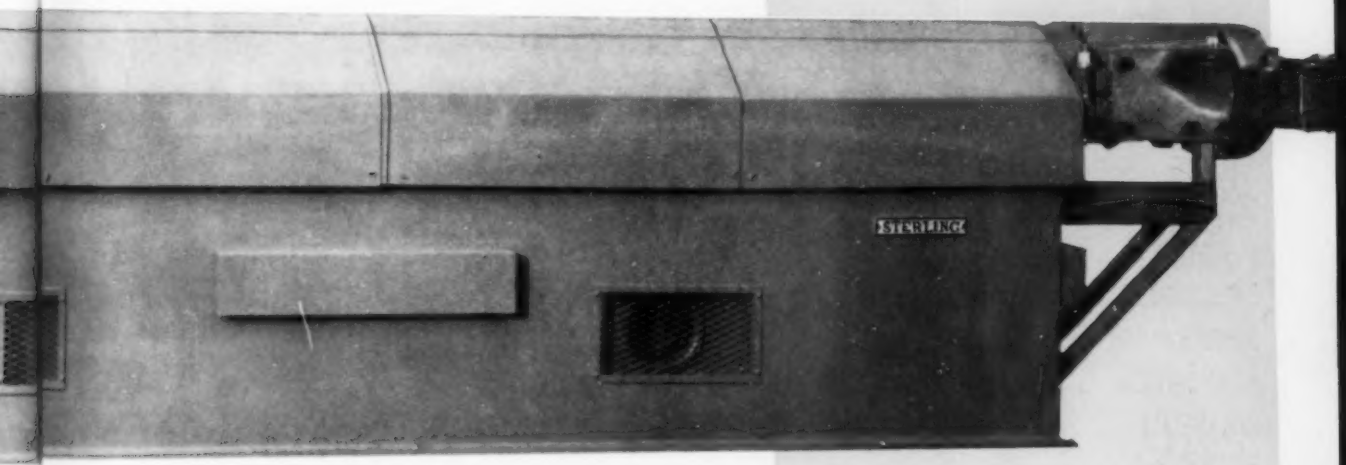

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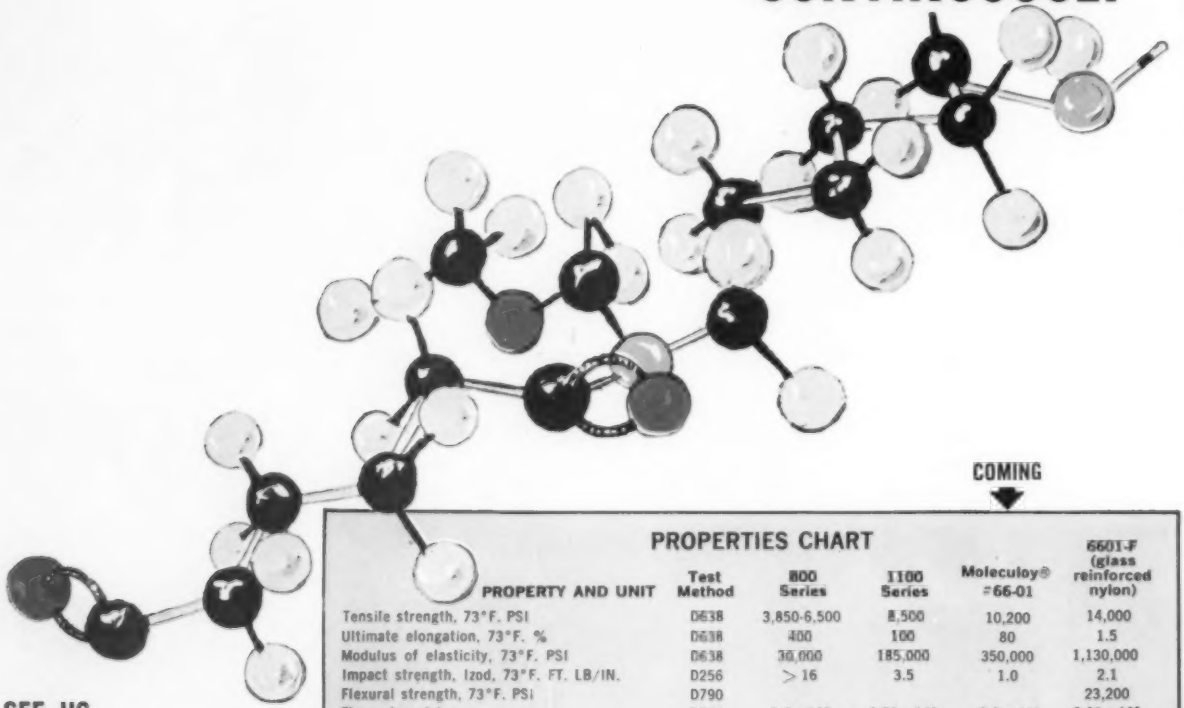

COMING

PROPERTIES CHART

PROPERTY AND UNIT	Test Method	800 Series	1100 Series	Moleculoy® #66-01	6601-F (glass reinforced nylon)
Tensile strength, 73°F. PSI	D638	3,850-6,500	8,500	10,200	14,000
Ultimate elongation, 73°F. %	D638	400	100	80	1.5
Modulus of elasticity, 73°F. PSI	D638	30,000	185,000	350,000	1,130,000
Impact strength, Izod, 73°F. FT. LB/IN.	D256	> 16	3.5	1.0	2.1
Flexural strength, 73°F. PSI	D790				23,200
Flexural modulus	D790	0.4×10^5	1.51×10^5	2.9×10^5	9.23×10^5
Hardness, Shore	D-1706	D-50-60		D-87	D-89
Linear coefficient of expansion, °F.	D696		0.00010		
Specific heat, CAL./G./°F.		0.40	0.58		
Deformation under load, 73°F. 2000 PSI, %	D621	6.20	2.02	0.39	0.12
Heat-distortion temperature, 264 PSI, °F.	D648		118	174	> 518
66 PSI, °F.	D648	129	154	410	
Dielectric strength, short-time, V/MIL	D149	342	425	380	495
step-by-step, V/MIL	D149	244		340	410
Volume resistivity, OHM-CM	D257	1.5×10^{11}	2×10^{13}	4.2×10^{13}	5.2×10^{15}
Dielectric constant, 60 cycles	D150	9.3		4.0	4.0
10^3 cycles	D150	7.7	3.3	3.8	3.8
10^6 cycles	D150	4.0		3.4	3.4
Power factor, 60 cycles	D150	0.19	0.03	0.015	0.017
10^3 cycles	D150	0.13	0.03	0.02	0.020
10^6 cycles	D150	0.08	0.02	0.04	0.022
Melting point, °F.	D789	284-298	367	487-493	486-489
Water sorption, %	D570	9.5	0.4	0.9	1.1
Specific gravity	D792	1.09	1.04	1.14	1.32
Clarity		transparent	translucent		translucent to opaque

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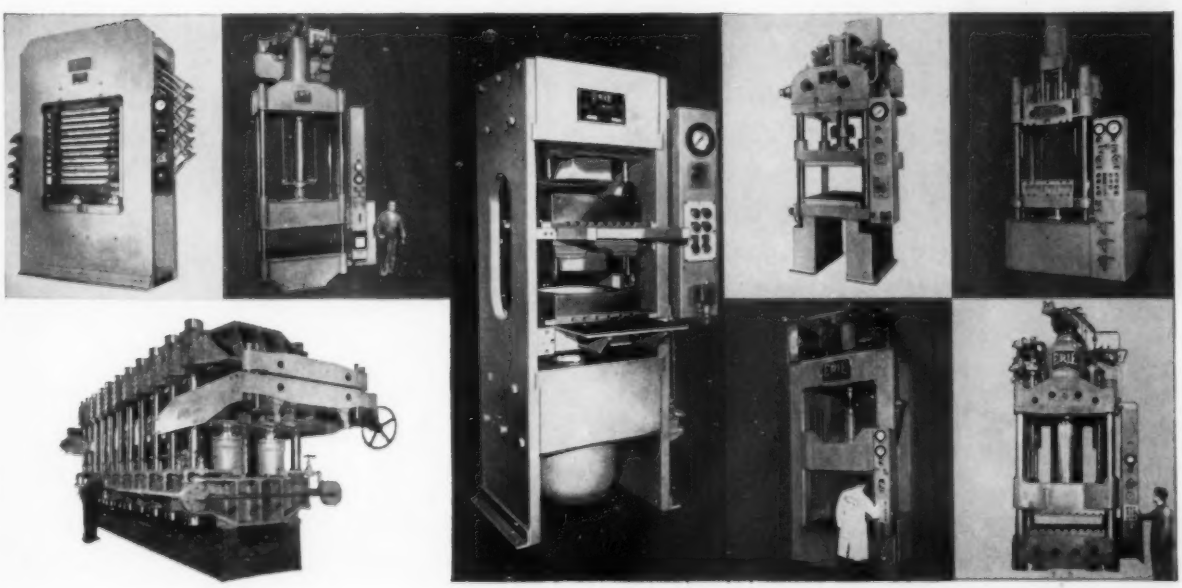

From Plastene—a world of precision plastics...

For 15 years, Plastene Corporation has been supplying customers in virtually every field with molded plastic products fabricated to a single standard: Plastene Precision. Such prominent firms as The U.S. Time Corp. (Timex), Fram Corp., Sears Roebuck & Co., The American Thermos Products Company, Amity Leather Products Co. and Lily-Tulip Cup Corp. are consistent users of Plastene's products and abilities.

What does Plastene Precision mean? It means molds designed by Plastene and built to its rigid specifications. It means precise engineering and skilled fabrication through every step of the manufacturing process. And it means prompt, efficient service from plants located in three strategic geographical areas — Crawfordsville, Ind., Norwich, Conn. and Anaheim, Calif.

Plastene is equally noted for design leadership. Its prominent designers are recognized for originality and creativity and for their intimate knowledge of the characteristics and scope of polystyrene, polyethylene, acrylic, delrin, polypropylene, acetate and nylon.

Whether your plastic requirements are simple or complex, Plastene's unsurpassed facilities and skills can fill them. Why not write today for further information?

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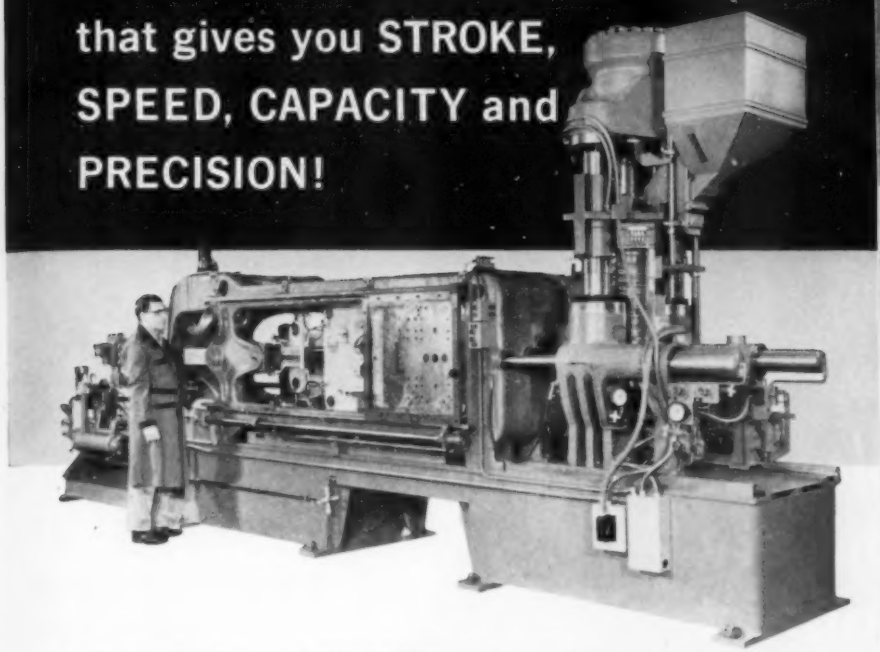
NOW! A 24/32 ounce LESTER that gives you STROKE, SPEED, CAPACITY and PRECISION!



Laundry Basket—29 ounces of linear polyethylene—14½" deep.

Toy Truck Body—21 ounces of modified acrylic—high gloss finish.

Automotive Air Shroud—19½ ounces of high-impact, high-heat styrene.

Chair Seat—28½ ounces of high-density polyethylene—256 square inches.

Here's why the new L-500-24/32 ounce Lester has won the unqualified approval of critical molders, who are using it to produce quality parts, such as those shown here. It has:

STROKE...a full 30″ of mold opening (adjustable by simple hand crank at the link cylinder to 8″). The maximum mold height of 30″ is conveniently and rapidly reduced to any dimension down to 9″ by use of the 3″ travel of the large central adjusting screw, in combination with standard 3″, 6″, and 9″ spacer rings.

SPEED...an overall cycle, at the 8″ mold opening, of only 7¼ seconds —at the 30″ movement, only 9 seconds. The high speed plunger stroke is aided by a rapid advance differential system, to provide a healthy 48 cu. ins. per sec. of filling speed during the major portion of the stroke.

CAPACITY...the most fully proven, simplest, trouble-free cylinder in the industry, capable of plasticizing 300 pounds per hour of general purpose polystyrene. The advantages of the vertical injection system include retractability for easy purging and the famous, foolproof, Lester nylon cutoff attachment.

PRECISION...the one-piece cast-steel frame provides 500 tons of CERTIFIED clamp that cannot go out of adjustment. The fully supported movable platen is aligned with mold-maker's accuracy to assure flash-free parts and longer mold life.

The L-500-24/32 ounce Lester—the modern machine for modern materials—is producing profits for molders of housewares and lenses, toys and pipe fittings. It can do the same for you. Write for specifications.

See the two NEW Lesters running at the Plastics Show, June 5-9, Booth 1224.

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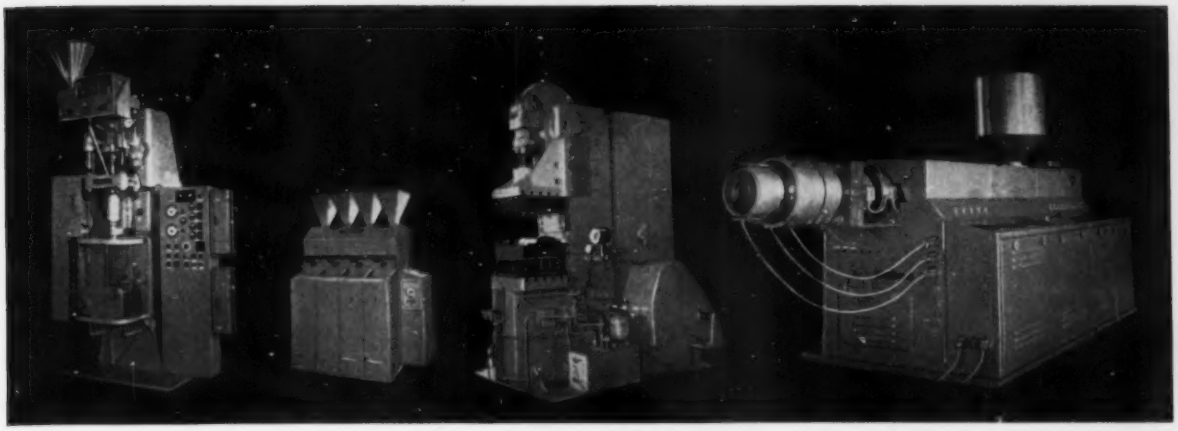

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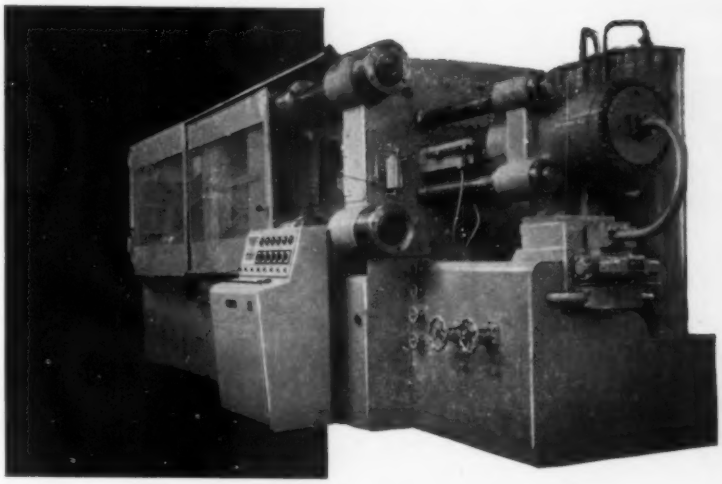

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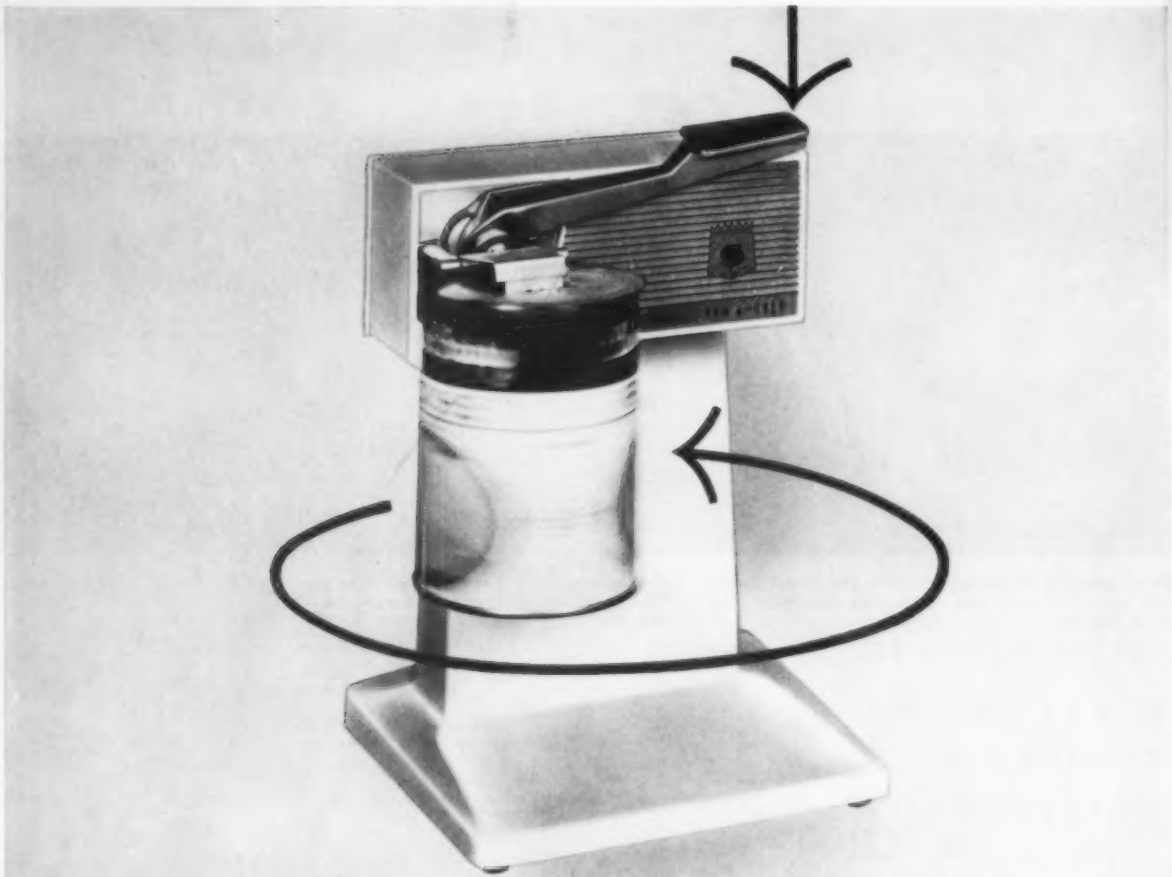

Silent nylon gears drive new Sunbeam electric can opener

Manufacturers are often able to gain more than cost savings through the use of custom-molded plastic components. A good example is this new Sunbeam electric can opener. To obtain quiet, maintenance-free operation, custom molded nylon gears were used instead of metal. For appearance, strength and ease of cleaning, Tyril®, a rigid thermoplastic, was used for the housing and base.

Chicago Molded sales engineers worked closely with Sunbeam designers in the selection of Nylatron® GS nylon for the gear train because of its sound-deadening, wear-resistant and self-lubricating qualities. Tyril was selected because of its resistance to acids, soaps, and food stains. Through the combined engineering skills of both Sunbeam Corporation and Chicago Molded Products, it was possible to design and produce more efficient, less costly components that resulted in a superior, better selling end-product.

Send for new brochure "Design and Purchase of Custom Molded Plastics."

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THE PLASTISCOPE*

News and interpretations of the news — By R. L. Van Boskirk

Section 1 — **May 1961**

Dow Chemical in container business

Dow Chemical's project for the manufacture of plastics containers has aroused considerable interest in the industry.

Presently the plan involves only formed containers and blown ware. They will be made of any material suitable for the job. In the formed container area, Dow is installing production equipment in its Findlay, Ohio plant, which will be in addition to the present PE film production facilities operated there by Dow's Dobeckmun division. Dow will use forming processes developed by the company as well as other processes and equipment licensed by the Conex Div. of the Illinois Tool Works. This is an in-line extrusion-to-finished-container operation. Up to now Dow is the only licensee of the Conex system. Sheet produced for this operation will not be marketed as such. Typical products produced will be containers for cottage cheese or other dairy products and drinking cups.

The blown ware will be made by Plas-Tainer Inc., Saline, Mich., under contract to Dow. Plas-Tainer is a subsidiary of Hoover Ball and Bearing Co., Ann Arbor, Mich., which makes the equipment from which a wide variety of blown products can be manufactured with emphasis being placed on bleach and detergent bottles.

The new project will be handled by the Dow Plastics Dept., with Grant W. Cheney as project director, and Corliss F. Cummins as marketing director. Both retain their present roles in the Dow Plastics Dept.—the former as rigid packaging project director and the latter as assistant to the plastics sales manager. They will be based at Dow headquarters in Midland, Mich.

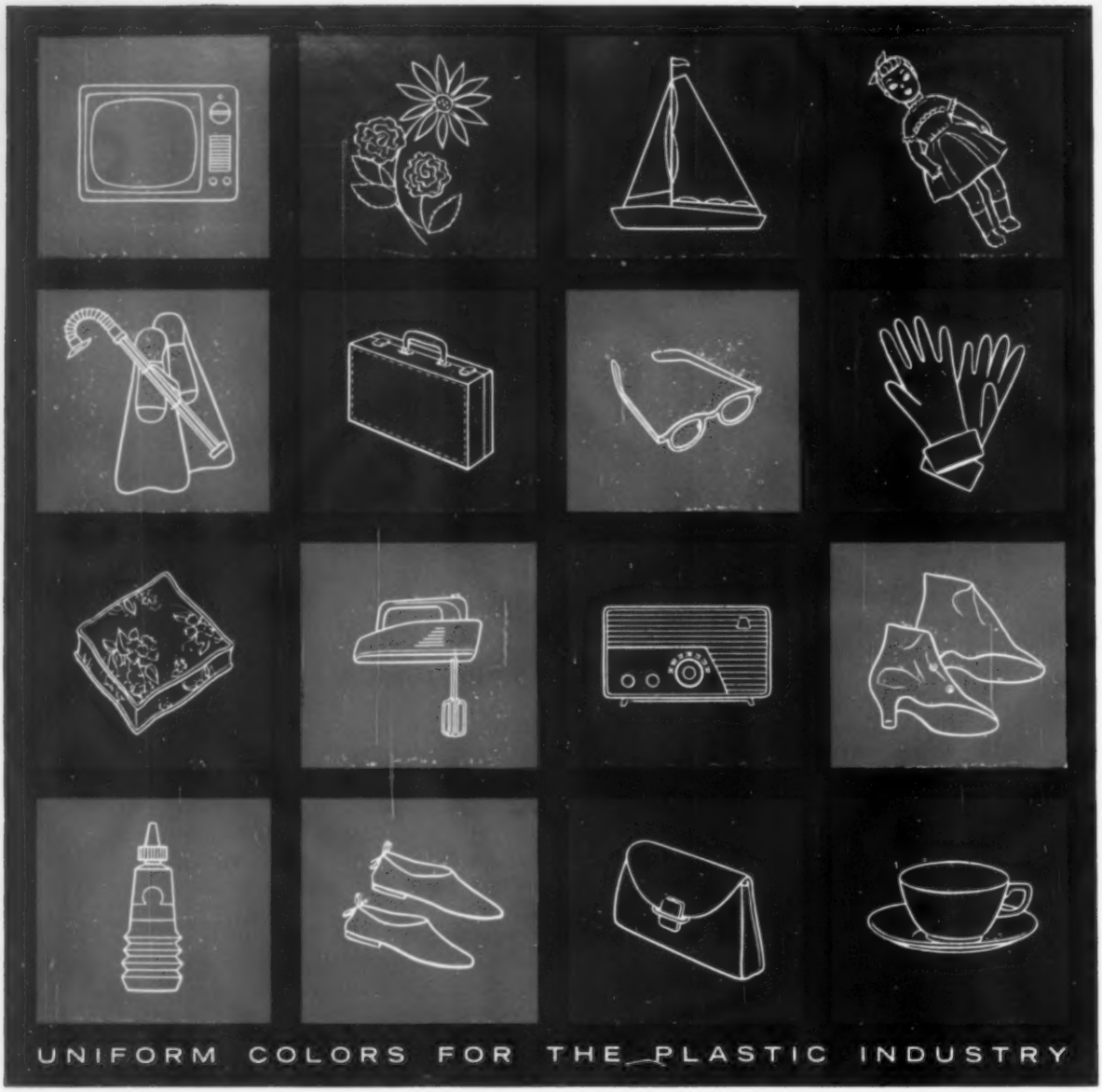
The container products will be marketed by whichever division of Dow is appropriate for that purpose. Thus, cottage cheese containers will be sold to the dairy industry by the Dobeckmun sales force; if a similar container were used for hard goods it would be sold by some other sales group. The idea is to have a flexible marketing system whereby goods can be moved to consumers through the most appropriate sales channels.

Ideas behind Dow's further expansion into consumer field

Ever since polystyrene (PS) became big volume in packaging, Dow spokesmen have been stating that such volume use requires big plants, plenty of capital, extensive promotion, intense marketing, improved design, and expert processing technique. Since PS volume for packaging has already reached nearly 100 million lb., and PE several hundred million, the market is a choice plum. But it isn't nearly as big as it can be. Plastics account for only 6% of the $19-billion packaging market. Dow aims to increase that 6% use of plastics by not only selling items made from its own materials in its own plants, but by satisfying big volume package users that the plastics industry can supply any demand no matter how large. Furthermore, it will pass on the techniques and experience it learns in processing to resin customers engaged in manufacturing similar plastics items in the belief that such knowedge will upgrade the entire industry.

This is not the first move in the direction of **(To page 37)**

*Reg. U.S. Pat. Off.



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consumer marketing, nor will it be the last in the plastics industry. And there are many plastics packaging specialists in the country who are well prepared to take the Dow or any other competition in stride. But the battle for business will get tougher and tougher—isn't it reasonable to hope that the toughness may breed more and better products, and a fair profit?

Polypropylene makes news in many areas

The biggest splash in polypropylene (PP) news over the last six weeks was probably the dedication of Hercules' new and second plant. The first plant, located at Parlin, N. J., has now an 80-million-lb. capacity and can produce either PP or high-density polyethylene (PE). The newly dedicated plant at Lake Charles, La., has a 60-million-lb. capacity, and another one of the same size is already under construction at the same site. Present capacity of the entire PP industry in the United States is somewhere in the neighborhood of 200 million pounds. The figure is uncertain because some companies don't tell, and some facilities may be used for low-pressure PE. Capacity could be twice this in 1963. Consumption in 1961 could reach 100 million lb., but this guess is subject to alteration along about August or September. The 1960 figure was somewhere between 35 and 40 million pounds.

The 42¢ price prevents competition with lower-cost plastics and some non-plastics materials. Eventually that price will come down, but it is dangerous to predict just when that time will arrive. Incidentally, it is interesting to note that planned capacity in other countries is almost keeping pace with that in America. This is an unusual circumstance that has seldom, if ever, occurred with any other plastics material.

Key to PP is stabilization

When polypropylene was first invented, there was some doubt as to its future because of oxidative degradation. But Hercules, with cooperation from Hoechst, developed a variety of stabilizing systems to overcome what might have been a fatal weakness. The company is generally recognized, even by its competitors, as the one whose stabilizer must be either equaled or surpassed. Other PP manufacturers have had to develop stabilizer systems to stay in business. Generally, stabilizers are selected according to the end-product for which resin is used. A system for film wouldn't be used for pipe, etc. These various systems are among the most closely held secrets in the chemical industry. Each company practically screams with joy and shouts, "Look, I've got one too!" when a successful "system" is developed by its technicians.

An interesting case in point is the story of heat-resistant PP. Many months ago Hercules offered 6512 Pro-fax as a resin that would withstand more heat after long exposure than general-purpose material, and charged 46¢ as against 42¢ for general-purpose. The price of 6512 Pro-fax has now been reduced to 42 cents. Another company, Enjay, has been asserting that its general-purpose resins 103, 104, and 105 had equally good long-term heat resistance and sold for only 42 cents. But in March, Enjay introduced Escon 125 molding grade, which is claimed to have even better heat resistance. The company has now also introduced a sheet-extrusion grade, 522. Both sell at 46¢, and the firm claims superiority in this area, but Hercules is now market-testing **(To page 39)**

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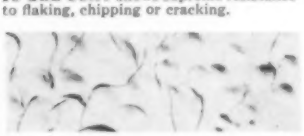
Make it brilliant or pastel. Bold or subtle. Make it shout or make it whisper. But make it COLOR to capture new sales in today's competitive markets.

It's so simple to do with IC Polyester Gel Coats. They're easy to apply and develop colors of maximum brilliance because of IC special dispersion techniques. And when you select a color from the IC rainbow you get the best permanence money can buy plus long term durability under the blazing sun, freedom from underwater cracking and high resistance to impact and abrasion.

IC Polyester Gel Coats are available in semi-rigid or resilient grades and in a wide range of colors including special matches on volume orders. They are compatible with each other and with all IC Polyester resins.

Make Interchemical your one-stop source for gel coats, color concentrates, hand lay-up and all other types of polyester resins and accessories. Ask your nearest IC representative about Interchemical's complete package for the Polyester fabricator.

After three years of immersion in water, IC GEL COAT shows supreme resistance to flaking, chipping or cracking.



Immersed in water for three years, this competitive gel coat flaked and cracked.

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CORPORATION
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Commercial Resins Department—1754 Dana Ave., Cincinnati 7, Ohio. Headquarters Office: 224 McWhorter St., Newark 5, N.J. Factories: Chicago, Ill. • Elizabeth, N.J. • Cincinnati, Ohio • Los Angeles, Cal. • Newark, N.J. • Mexico City, Mex. In Canada, these gel coats are made by Chemical Oil & Resin Company, Toronto, Ontario and sold under its trademarks. **IC is a trademark of Interchemical Corporation.*

another long-term heat-resistant material which is claimed to be superior—and so it goes.

One of the principal products for which these long-time heat-resistant products are useful is television backs, and every producer sells a formulation for that purpose. The competition for this type of stabilized material used in high-heat applications is getting rough.

Moreover, the variety of PP resins sold by each producer is rapidly increasing. Scarcely a week goes by without a supplier announcing a new formulation—AviSun brought out three at once with food-grade eligibility and high flow featured. Spencer brought its number of formulations up to nine with three new resins for injection-molding—two for food containers and one for long-term heat resistance. A molder or extruder must indeed be confused with variation of formulations in PP, a resin still in its infancy. And this is only a tiny beginning of what is to come—eventually there will be far, far more PP and copolymer formulations than there are today in PE.

Another way to get confused about PP

Tennessee-Eastman has issued a press release to correct reports circulated after a recent press conference concerning its two processes for manufacture of PP.

The correction refers primarily to the process used at the Kingsport, Tenn., pilot plant rather than the one that is used in producing PP in a commercial plant at Longview, Texas. The Kingsport process does *not* employ aluminum sesquichloride as a catalyst and was *not* represented as highly "isotactic." The Kingsport process forms a highly crystalline product which is a different polymer designated as the "stereosymmetric" polymer of propylene. It can be sold both in the U. S. and abroad—the Longview process will be used to supply domestic customers. The company has many patents, both granted and applied for, on both processes, all based on work in the Eastman organization. The patent situation in PP is probably more confused than that of any plastic ever invented. The "interference" tangle in the Patent Office is said to involve five companies, only one of which is making commercial PP in this country. The whole situation may become a more lucrative field for lawyers than for producers. However, most producers seem to be ignoring the situation, figuring that they may eventually have to pay a royalty, and are going about their business with the belief that hesitation on account of patent problems would leave them far behind in the race.

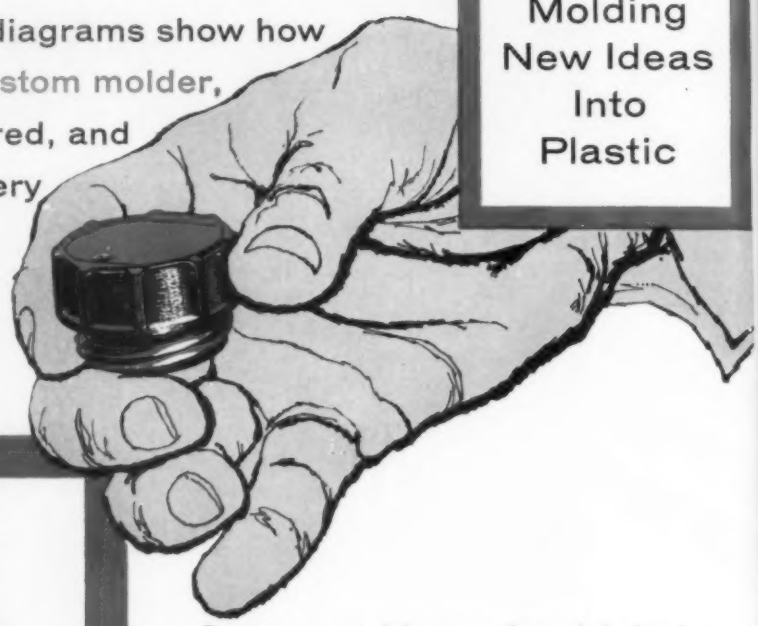
Patent troubles with polymerized formaldehyde

The Du Pont Co. has filed suit in the U. S. District Court of Delaware charging infringement of its patent on Delrin acetal resin by the Celanese Corp. of America. Du Pont has asked the court to enjoin Celanese from manufacture and sale of an acetal resin which Celanese had trademarked Celcon. The patent said to be infringed was No. 2,768,994, issued Oct. 30, 1956.

Celanese was well aware of the patent claims for acetal resins before it announced Celcon, even carefully pointing out that it was a copolymer rather than a homopolymer, and the firm is reportedly prepared to defend its position. Celanese claims to be the largest formaldehyde producer in the world, with years of research and many different formulations behind it. Other formaldehyde producers who have been contemplating entering the field with a **(To page 41)**

Molding New Ideas Into Plastic

These diagrams show how Minnesota Plastics, a custom molder, designed, engineered, and mass produced a battery cap that guarantees protection from "battery blow-outs"



Two-piece, patented, plastic cap is machine assembled. Prongs on lid snap out tight after insertion through bottom slot. Assembled cap is shown below.

Note opening of bottom air slot after insertion of prongs. If bottom slot is too small or absent, breakage occurs and cap is automatically rejected. Proper gas passage is thus guaranteed on all finished vents.

Pressures created by gases formed during battery charging can cause auto batteries to blow out. An escape vent in the battery cap is supposed to prevent this.

But in the process of manufacturing conventional plastic battery caps, these vents sometimes fill in. And despite the most thorough inspection systems, some defective caps find their way onto batteries. The result: a blown-out battery for the user and embarrassing explanations for the maker.

Could Minnesota Plastics make a better battery cap asked one of our customers. A foolproof cap? One so good that not one in total production would go wrong?

Minnesota Plastics answered by engineering the entirely new cap idea you see on this page. Ingenious, low-cost, *guaranteed*. This two-piece plastic cap *must* have an open air vent or it cannot be assembled. It is now being mass produced only by Minnesota Plastics.

This story shows why Minnesota Plastics is more than just a molder of plastics. Here is a complete plastics molding service that works as if it were your own department. Use it to save yourself time and money . . . and to make your product better. Write or wire Minnesota Plastics today.

m p c

PIONEER MANUFACTURER OF NEW PRODUCTS IN PLASTIC

Minnesota Plastics Corporation

45 EAST MARYLAND AVENUE • SAINT PAUL 17, MINNESOTA

polymerized formaldehyde resin will now, no doubt, rest on their oars and watch the Du Pont Celanese proceedings.

New ethylene copolymers

Copolymers with properties that seem to fit in between vinyl chloride and polyethylene have been announced by Dow Chemical Co. and Union Carbide Plastics Co. Dow calls its material Zetafin and says it is a copolymer of ethylene and ethyl acrylate. Union Carbide designates its material Bakelite DPDB-6169, but doesn't name the second monomer. However U. C. introduced an ethylene-ethyl acrylate copolymer about two years ago for use in large moldings, like trash cans, for better flow and lower-temperature properties, and its new material is presumably a member of the same family. The new material, as described by Dow, would be something like a plasticized vinyl chloride, but without the plasticizer. Thus, there is no danger of plasticizer migration, nor is there any need for compounding or any danger of thermal degradation during fabrication.

Dow offers Zetafin in three formulations—one has a low melt index (2.5) for extrusion and blow molding; another has the same M.I. but incorporates anti-block additives and is suggested for place mats, draperies, table cloths, and inflatables; the third has an M.I. of 18 and is suggested for injection molding, where it is said to offer flexibility and surface gloss. All formulations are said to flow easier than polyethylenes of comparable M.I., as would be expected of a material containing ethyl acrylate. It is said to have a pleasant apple-like odor when being molded. The material is priced at 32½¢/lb. in quantity lots, and can be filled up to 35% with "low cost" fillers. Because of its low density, 0.93, it is competitive with a 1.35-density material selling for 22.5¢ a pound.

Union Carbide says its copolymer is four times as flexible as conventional PE at room temperature; three times at −25° C. Its stress-crack resistance is equivalent to vinyl and superior to conventional PE. It is regarded as a new material, rather than a modified PE, with flex-cracking resistance of rubber, resilience and elongation of low-density PE, and stress-cracking resistance of vinyl.

Grace to distribute polypropylene for Montecatini

An agreement has been reached between W. R. Grace & Co. and Chemore Corp., U. S. representative for Montecatini, to cooperate in the marketing of polypropylene whereby Grace's Polymer Chemicals Division will market polypropylene produced in the new plant being built in W. Va. by Novamont Corp., a subsidiary of Montecatini. The latter's trademark, Moplen, will be used by both W. R. Grace and Chemore. The Novamont plant will have initial capacity of 25 million lb., and will go on stream in the third quarter of this year.

More vinyl for construction

Two significant recent moves indicate the use of more vinyl chloride in the construction industry. One is the announcement by B. F. Goodrich Industrial Products that 14 manufacturers have been established to produce and sell combination storm windows and doors fabricated from rigid Koroseal extrusions. The second is a statement from Tensile Products Ltd., Harpenden, Herts, England, that its subsidiary, Melwood Thermoplastics Ltd., is producing **(To page 43)**

Motor display made by Moldcraft Inc. for Johnson Motors, Outboard Marine Corp. Plastisol formulated by A. P. Nonweiler Co.

Monomer X-970 raises hardness and heat distortion temperature of vinyl products

This outsized outboard motor is a rigid display piece, made from a plastisol fortified with Rohm & Haas MONOMER X-970. Its hardness and rigidity would be difficult if not impossible to obtain with an ordinary plastisol formulation.

MONOMER X-970, a thermosetting modifier for PVC plastisols, is a high-boiling, low-viscosity ester that can be polymerized by heat or catalysts to a cross-linked polymer. Here's what it does when added to your plastisol: (1) it actually lowers the viscosity of your formulation, and (2) through thermosetting action, it gives you a much harder product than you could get without it. Finished pieces have good impact strength and outstanding resistance to deformation by heat.

Plastisols modified with MONOMER X-970 show these properties: (1) workable viscosity even at low plasticizer levels, (2) practical working life, (3) adaptability for use in rotocasting, slush molding or coating. Their low viscosity permits easy filling of finely-detailed molds, and provides even distribution of material to give pieces with uniform wall thickness. Cure is accomplished at ordinary fluxing temperatures. Rigidity of finished articles allows mold release at higher than usual temperatures—this results in speedup of production cycles.

Write to Dept. RP-4 for complete technical information and sample of Monomer X-970.

ROHM & HAAS

PHILADELPHIA 5, PA.

a wooden window frame over which vinyl chloride is extruded. For details see "Report from England," p. 142.

P. W. Perdriau, president of the Goodrich division, says that his company's move is the first to compete for a share of the $500-million annual market in storm windows and doors now dominated by aluminum and wood.

The white extrusions have been field-tested in window and door construction for more than three years. The shapes needed for frames, kick plates, and other parts are extruded at the company's Marietta, Ohio plant. The company claims that no other material can compete on the same basis of quality, performance and long service life and, furthermore, that the finished storm windows are competitive in cost with wood or metal. It wears longer, insulates better, keeps its appearance indefinitely (integral color), and costs nothing to maintain.

Plastics at the Packaging Show

It is no longer possible to highlight plastics features at the annual Packaging Show. There are too many and it is neither fair nor possible to evaluate the relative importance of each. Yet it seems comparatively safe to say that the most talked about subjects in the aisles, corridors, and hotel rooms were: 1) Dow's announcement of its entry into the manufacture of containers; and 2) Du Pont's managing to effect a drop in the price of cellophane by increasing the yield in square inches per pound. The Dow story is carried in another section of this department—the cellophane story is of interest in this magazine primarily as it relates to competitive costs with plastics films. In thin gages the latter is still less costly than the new cellophane.

The plastics film situation in packaging, as evidenced at the show, is still dominated by conventional polyethylene. Yet cellulose acetate, oldest of the plastics films used, has tripled in sales in the last five years. More queries on acetate were received at the Celanese booth than about any other item exhibited by the company. The popularity of blister and skin packaging has, of course, helped, but Celanese spokesmen pointed out that improved formulations, such as S 704, with variations for different products, extra impact, better draw, built-in shrinkage that can be controlled to the amount desired, etc., have been important factors in this growth. The comparatively new PE-coated acetate is now being widely used in skin packaging since PE sticks to uncoated board.

Polyethylene bottles were probably more evident in more places at this show than any other single item, with everybody out to capture a portion of the huge market available in detergent and bleach bottles. There is no longer any doubt of their practicality. The only question is—how big will the market become? Two observations might be added: 1) blow molding is rapidly expanding from relatively small bottles to huge pieces such as 80-gal. containers that won't have to be lined with other materials, and even larger pieces that are not related to packaging; and 2) One company, at least, is working on a 0.939-density conventional PE for bleach bottles that won't stress crack—heretofore detergent and bleach bottles have all been made from low-pressure, higher-density resins.

Queen of the plastics films is still polyethylene

At least from a volume standpoint, PE film is now available in so many varieties that a user could have trouble deciding which is best. Every resin **(To page 45)**

Time out for admiration with TITANOX®

TITANOX titanium dioxide pigments add eye-catching beauty and sales appeal to a wide range of rubber and plastic products—including white and light-colored luggage that attracts admiring glances.

For many rubber and plastic products TITANOX-RA or TITANOX-RA-50 provide outstanding whiteness, brightness and opacity. Where weather resistance is of prime importance TITANOX-RA-NC may be preferred. Also new TITANOX-RA-40, rutile TiO_2, yields clean, bright whites and sharp tints at economically low loadings in many compositions. No matter which you choose, all TITANOX pigments have the ease of dispersion and uniformity that increase production efficiency.

For complete information on the type of pigment to meet your requirements, consult our Technical Service Department. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities. In Canada: Canadian Titanium Pigments, Ltd., Montreal. 7909

TITANIUM PIGMENT CORPORATION
SUBSIDIARY OF NATIONAL LEAD COMPANY

TITANOX

Division of Rubber Chemistry—A. C. S. Convention—Louisville, Kentucky—April 19, 20, and 21

producer now offers half a dozen or more film-grade resins, with new ones announced with great frequency. The present tendency is to offer a resin with a combination of clarity and strength not previously available in one formulation, which often permits use of thinner gages. Even more impressive is the advance made in blown film, which can now be obtained almost as clear as cast film.

Much of the improvement in film comes from use of higher-density resin. Still more of the old-style 0.918-density resin is used, but the medium densities—of from 0.925 to 0.935—are gaining ground rapidly because of improved properties such as clarity, sealability, and feed-out on a wrapping machine.

Vinyl chloride in packaging

Vinyl has never been a major material at packaging shows. But this year one of the outstanding exhibits was Nixon-Baldwin's Vynex 5- to 80-gage unplasticized, clear, calendered vinyl sheet in 24-in.-wide rolls, which is said to be made from low-cost general-purpose resin. Spokesmen assert it will be less costly and have superior properties over other transparent plastics generally used for bubble or blister packaging. A spokesman said that if a customer finds a fish-eye he can have the roll for nothing. FDA approval is claimed on this calendered stock so that it may now be used for formed food packages. It sells for about 71¢/lb., compared with cast vinyl at around $1.00, and can be obtained in heavier gages if desired.

Another vinyl, Reynolon shrinkable PVC film, was being promoted vigorously for produce, baked goods, and bundle multipacking of cans and canisters. The potential market was listed as 15 million pounds. Twenty-five million more pounds could be divided among record albums, foods, textiles, candy, paper products, and as a lamination for returnable beer cases, according to Reynolds.

Still another vinyl application was Goodyear's Vitafilm, an extruded plasticized vinyl film that has been around for several years, but is steadily decreasing in price and is now available in gages of from ½ mil and up. A new formulation especially for wrapping bacon is now available at 73¢/lb., with a yield of 28,600 sq. inches, the equivalent of about 2½¢ per 1000 sq. in., which makes it less costly than most any other film sold for this purpose. It, too, is now used in skin packaging of from ½ to 7 mils, and the shrinkable Stretch Pak brand in rolled stock is exceptionally applicable to wrapping paper product. A new application was a 2-mil wrapper to replace PE bags for packaging tire tubes.

New films on the way

Tennessee-Eastman popped corn which had been enclosed in sealed bags made of its new polyester film (Terafilm). Popping was done on a special machine that carried the bags on a conveyor belt for a 3-min. ride in 290° heat.

Visking displayed Hylox film, a water-soluble material made from Union Carbide's Polyox resin. Like PVA soluble film, it is suggested for applications such as dry detergents, bleaches, similar household items, and chemical powders such as insecticides, dyes, etc., that need to be used in exact amounts. The film can be heat sealed at about 150° F. on conventional forming and filling equipment, and will withstand cracking down to —70° F. More Packaging Show news starts on p. 372.

For additional and more detailed news see Section 2, starting on p. 358

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Ultrasonic film sealer

Proving its versatility, ultrasonic energy is now used in a new machine called the Plastics Sonoseal to seal most types of plastic film to itself or other materials. Seam widths from 0.030 to 0.1 in. wide can be made at rates up to 600 in./min. on films

ranging from 0.8 to 12 mils in thickness. Using special techniques, sheet up to 20 mils thick can be bonded. Since only a minute amount of heat is generated (the bonding is done by bringing the molecules of material close enough to promote adhesion or cohesion), the ultrasonic sealer can be used to seal oriented films without the difficulties which occur with heat sealing methods. Another advantage of the ultrasonic sealer is that the compressive wave which is used will "sweep" foreign matter away from the sealing area, so that plastic film seals can be made through the contents of the plastic bag or construction. The ultrasonic energy is produced by a generator with an output of 100 w. at frequencies between 20 and 50 kc., using an electrical input of 350 w. at 120-v., 60-c.p.s. ac. Sealers are available in two forms, either in a console model, similar to a sewing machine in appearance, or the unmounted ultrasonic generator and welding head. Price of the console is $2450, and the unmounted unit is priced at $980, both F.O.B. mfr. *International Ultrasonics Inc., 331 Centennial Ave., Cranford, N. J.*

Blow molder

The Blowmaster Type 10 has been designed for the automatic production of blown containers with diameters up to 9 in. and heights up to 20 inches. Special attention has been given to the rapid ejection of parts by eliminating tie bars in the clamping unit which might impede parts removal. The parison extruder is equipped with a hydrostatic transmission which allows the screw to be stopped within one-half revolution, minimizing extrudate loss. Screw speed is infinitely variable in the range from 0 to 100 r.p.m. The unit may be operated with either one or two molds and two items of different shape can be produced if the parison required for each item is the same. In operation, a central mold platen moves back and forth between two stationary platens. The moving platen has knives mounted on it which clip the required parison as it is clamped between halves of one of the molds. A single parison head is used to feed both sides. Clamping is done by a combination of pneumatic cylinders and a positive hydraulic-mechanical locking system. Maximum clamp force is 10 tons. Parison length and cycle timing is controlled by a photoelectric system. Typical production rate for a 40-oz. container weighing 4 oz. is 250 parts/hr.; for a 3-gal. container weighing 18 oz., 50 parts per hour. *Amigo Machine Co. Ltd., Skylon House, Park Royal Road, London NW10, England.*

Extruded rigid vinyl sheet corrugating unit

Through the joint development of a special rigid vinyl compound by B. F. Goodrich (Geon 82304) and an NRM special corrugated sheet forming unit described below, it is now possible to make rigid vinyl corrugated sheeting for industrial and other building applications. The corrugated sheet-forming unit is designed to continuously form 48-in.-wide trimmed PVC sheet in conjunction with a special NRM extrusion sheeting die. Former consists of intermeshing trapezoidal tooth platens; spacing between the platens is adjustable to suit the sheet thickness and platen movement is air actuated. Maximum depth of corrugations is 1 in. (greater in some configurations). Platens are designed for use of a recirculated water temperature control system, which is included. Unit also includes a one-zone temperature control unit and a steel carriage, mounted on casters for track mounting, which carries the controls. Price of the forming unit only, F.O.B. Akron plant, is about $5600. *National Rubber Machinery Co., 47 W. Exchange St., Akron 8, Ohio.*

NRM special rigid vinyl sheet corrugating unit, showing entrance side of forming die. Air cylinder at right adjusts for sheet thickness.

(More on page 48)

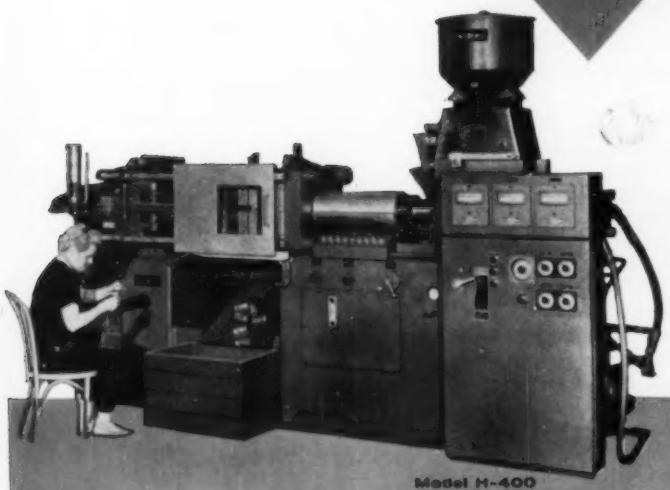
* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of Modern Plastics do not warrant and do not assume any responsibility whatsoever for the correctness of the same or otherwise.

"COMPLETE AUTOMATION"

Prominent toy manufacturer operates their fully automatic Van Dorn 3 oz. presses 24 hours per day, 6 days per week. They also report their Van Dorn presses substantially reduce cycle time, are economical, versatile, and require minimum maintenance.

Model H-300

GAIN 3 WAYS with VAN DORN Presses



Model H-400

"PACKAGE SERVICE"

The user of this Van Dorn 4-6 oz. press had a well conceived idea for a plastic part, but no molding experience. So they had Van Dorn engineers help them procure a well designed mold from a competent moldmaker; then checked the operation of the finished mold on a Van Dorn factory demonstration unit. This free Van Dorn "Package Service" insures satisfaction, helps produce profits.

Model H-260

"25% LESS CYCLE TIME"

This is the report of a progressive custom molder about his Van Dorn 2½ oz. presses. He also says that they "give fast set-ups, and less waste in purging from one material to another. Van Dorns are extremely fast, versatile and economical."

Write for Illustrated Specification Bulletins on these Van Dorn Plastic Presses.

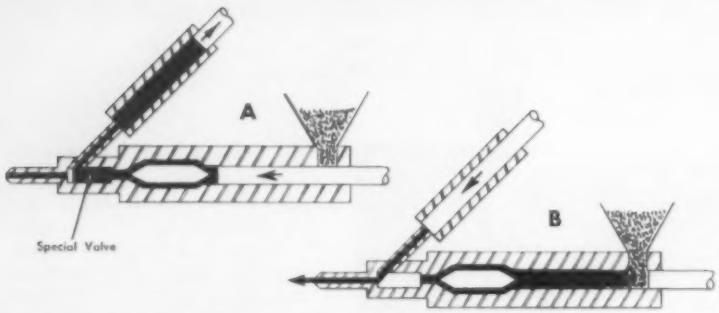
Van Dorn

THE VAN DORN IRON WORKS CO. • 2685 EAST 79TH STREET • CLEVELAND 4, OHIO

Sales and Service Nationwide In Canada: B. J. Dennis & Assoc., Ltd., Toronto, Ontario

NEW MACHINERY-EQUIPMENT

(From page 46)



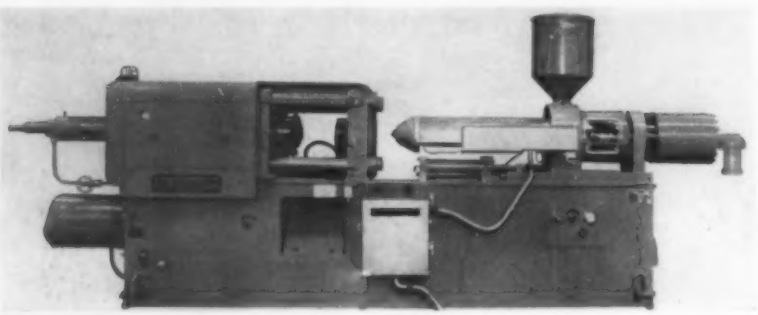
IMPCO SECOND-STAGE INJECTOR. Schematic A (top, left) shows injector being filled with melt through special valve. Schematic B (right) shows injection into the mold.

Injection machine attachment provides preplastication

In essence a ram accumulator for injection machines, the Impco Second-Stage Injector, is a device which effectively converts a conventional injection machine into a preplasticating machine. It consists of an auxiliary, torpedoless heated injection cylinder, which is attached in piggy-back fashion to a conventional machine cylinder. The auxiliary cylinder then takes over the shooting function of the injection system while the original machine cylinder becomes a preplasticating cylinder. The new device may be installed on most Impco injection machines in the field, and it is available on all new machines. It, of course, makes available to the owner of the conventional machine model the advantages of a preplasticating machine and results in increasing the plasticating capacity of the injection unit. *Improved Machinery Inc., Nashua, N. H.*

Reciprocating-screw injection machines

To be introduced at Europlastica (Ghent) and Interplas (London), these six models of the New Peco Rotothrust machines offer a wide range of shot sizes (2 to 178 oz.) and clamping (80 to 750 tons). Alternate screws for each model maximize flexibility. Injection pressures of 9000 to 18,000 p.s.i. are available. The injection system has a long screw and X-alloy barrel for smooth cylinder temperature gradient, low slip, increased plasticating rate, better melt temperature control, and improved cylinder-dispersion characteristics. All screws have a valved head to prevent backflow during injection. Each machine comes with 2 nozzles; one for general use and a 3-position shut-off nozzle for low-viscosity melts. A novel drive both rotates and reciprocates the screw, eliminating the need for an auxiliary drive. No thrust bearings are used; screw back pressure is balanced against the hydraulic injection pressure (adjustable by simple relief valve). Screw speed is steplessly adjustable. Larger machines have two speed ranges. A limit switch adjusts shot volume according to screw-ram travel. Clamping is hydraulic-toggle type. Mold stroke is adjusted by a single central screw (motorized on larger models) and platen construction is extra rigid for big molds. Central or outside ejection is provided on larger machines. *Peco Machinery Sales (Westminster) Ltd., Subs. of Projectile and Engineering Co. Ltd., 28 Victoria St., London S.W.1., England.*



Compression press

This small, 20-ton Bipel compression press is fully automatic in operation. The unit has been designed for minimum cycle time and simple operation. The standard model comes as a self-contained machine but can be supplied to operate from an external hydraulic system. Press-open time, excluding cure, is 5 seconds. The machine can be adapted for either top or bottom automatic ejection and can be operated fully automatic or manually for set-up and test runs. Any form of electric heating can be used. *B. I. P. Engineering Ltd., Pemberton House, East Harding St., London E.C.4, England.*

Laminating press

For the production of small laminated sheets, this press consists of press frame and platens, motorized hydraulic unit, and control console. It contains five 19-by-19-in. electrically heated and water-cooled platens (4 work openings), whose temperature may be adjusted up to 600° F. Clamp force is adjustable from 0 to 75 tons. Each operation of the press cycle can be controlled separately, or a sequence timer is included to allow the operator to automatically preset platen closing, platen opening, application of pressure, and platen heating and cooling cycles. Console and press are mounted on the same base. *Kingsbacher Murphy Co., 9830 Bellanca Ave., Los Angeles 45, Calif.*

Vacuum former

The Model VF2436 vacuum former is designed for the production of skin packages and small plastic parts from roll stock plastic sheet 12 to 36 in. wide. The machine is a 6-in. updrape unit with diffused zone heating, and has an adjustable clamp which can be varied in 1-in. steps from 12 by 12 in. to 24 by 36 inches. Heating is done from one side using four independent zones; heater contains 21 heater rods and can be placed between 2 and 11 in. from the sheet. Either spray or fan cooling is available. Sheet is advanced through the machine between 12 and 30 in. per second. A 1-hp. pump provides a vacuum of 20 to 28 in. of Hg., and it takes about 15 sec. to pump down to 3 p.s.i.a. Ejection is by air. Complete unit, including automatic roll feed, take-off rack, vacuum tank, and motor, exclusive of accessories, is priced at $7600 f.o.b. factory. *Tronomatic Machine Mfg. Corp., 25 Bruckner Blvd., Bronx 54, N. Y.*

(More on page 50)

PRODEX

presents the new

COMPACT EXTRUDER

OUTPUT RATES: 50—150 lbs/hr

L/D RATIOS: 20:1 and 24:1

PRODEX-COMPACT QUALITY FEATURES INCLUDE

- Heavy integral machine/motor base requiring half the space needed before.
- Alloy steel screw. Screw flights hard surfaced with Stellite (not flame hardened). They maintain their hardness, Rockwell C55, through highest extrusion temperatures.
- One-piece heavy wall cylinder Xaloy-lined.
- Thrust assembly with self-aligning spherical roller thrust bearing, large inspection window and circulating oil lubrication system.
- Large rectangular feed opening.
- Swing gate for easy die mounting.
- Automatic temperature control.
- Efficient air cooling.
- Full instrumentation, including screw speed indicator, melt temperature indicator and motor load ammeter.
- Continuously adjustable speed range 4.5 to 1.
- Completely prewired ready to run.

PRICED TO REALLY COMPETE

SEE THE PRODEX-COMPACT EXTRUDERS, HT EXTRUDERS, BLOW MOLDERS AND PRODEX-HENSCHEL MIXERS AT THE NATIONAL PLASTICS EXPOSITION — **Booth No. 1001**

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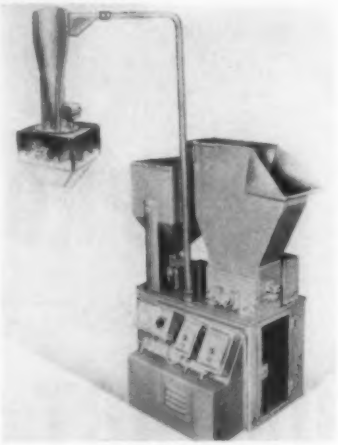
NEW MACHINERY-EQUIPMENT

(From page 48)

Blender-granulator loads directly into hopper

The improved version of the Blendomatic Granulator mixes virgin material with regrind as the reworked material is generated, and then loads the mixed material into the hopper of the injection machine or extruder. Included in the unit's design are a new discharge system and an automatic machine hopper level control. Up to 65 lb. of virgin material can be loaded into the granulator, which then blends it with regrind in a preset ratio. The granulators are available in four capacities ranging from 200 to 500 lb. per hour. Standard and wide-feed throat models have heavy duty double-shear knife actions. *Ball & Jewell Inc., 24 Franklin St., Brooklyn 22, N. Y.*



High-frequency film surface treaters

Designed for continuous duty, Lepel high-frequency spark generators can be used for the surface treatment of PE films and are available in two models. Model HFSG-2 is capable of treating material at a rate of about 1000 sq. ft./min., using a 60-cycle power input. It can be adjusted to treat any web width up to 8 ft. at lineal speeds consistent with the area capacity above. It requires a maximum power input of 1.5 kw. at 115 or 230 v., using 60-cycle single-phase power. Power can be reduced in 60 steps to 100 watts. Operating frequency is about 450 kc. Model HFSG-6 will handle about 5000 sq ft./min., using a 60-cycle input. Maximum web width is 15 feet. Maximum power input is 5.5 kw. at 230 or 460 v., using single-phase 60-cycle input at unity power factor. Input power can be reduced in 20 steps over two ranges from 5.5 kw. to 1 kw. Operating output frequency is about 250 kc. Hot electrode is of the knife type. Treating roll electrode is covered with a dielectric sleeve of Pyrex or Mylar. *Lepel High Frequency Labs. Inc., 55 St. and 37 Ave., Woodside, N. Y.*

Mixing tanks

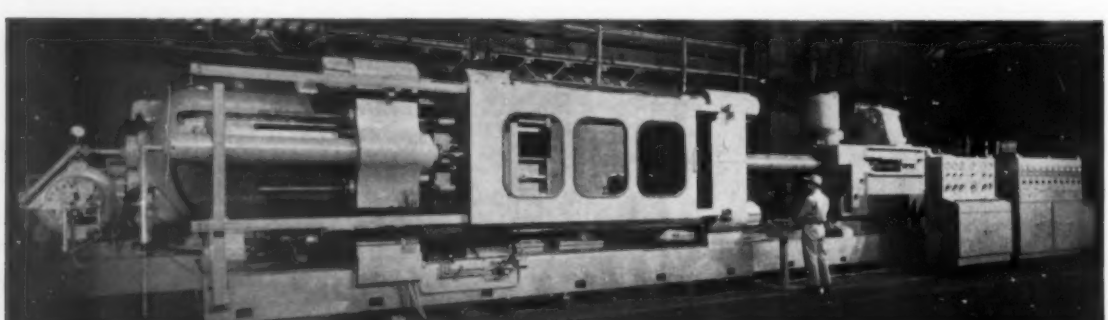
Suitable for use in the preparation of liquid resin formulations and solutions, these stationary tank-type dispersers are available in various sizes from 5 to 3000 gal. and with impeller speeds up to 5000 r.p.m. Stainless steel impellers are of two types: sawtooth disk or multiple action millhead. Tanks are provided plain or jacketed, with several optional types of outlet gates, and with legs to raise the outlet to any level above the floor. *Charles Ross & Son Co., 148-156 Classon Ave., Brooklyn 5, N. Y.*

Vacuum former

For sample runs and exploratory design work, the Comet Jr. will do blister forming, skin packaging, drape and vacuum forming. Heating, draping, seal-off, and the application of vacuum can be set for automatic operation. Mold area is 10 by 10 in.; sheet size is 11 by 11 in., and sheet thicknesses from 1 to 125 mils can be handled. Drape stroke is 4 in.; drape pressure is 80 pounds. Heater area is 1-ft.-square, and heaters may be adjusted 4 in. on cycles ranging from either 0 to 120 sec. or 0 to 240 seconds. Unit requires 110-v. a.c. supply and compressed air source of 80 p.s.i. Unit is supplied complete with controls, vacuum system, vacuum regulator and filter, air regulator and filter, and lubricator. *Comet Industries Inc., Franklin Park, Ill.*

Monster machine can be used as either injection press or extruder

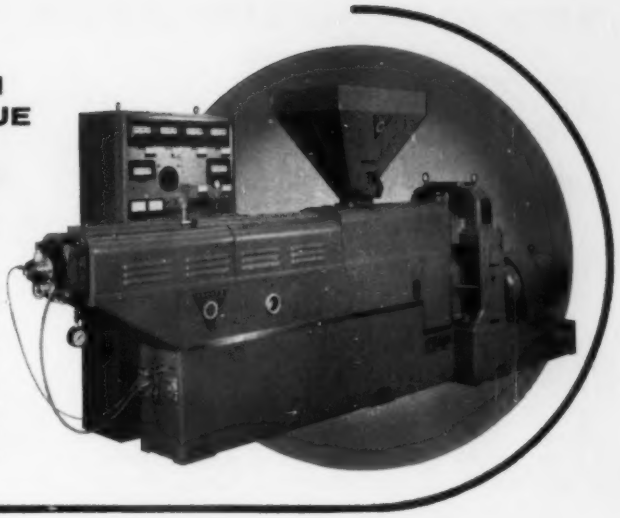
Taking over the lead in the competition for the title of "largest injection machine in the world" is the Meiki SJ-150 1000-oz. giant. A new approach to the design of large machines, this unit uses a reciprocating screw injection system, rather than the conventional piggy-back preplasticator arrangement. Also novel is its swivel mounted 6-in. screw injection system, which allows the barrel to be rotated away from the mold clamping section so that the injection end can be used as an extruder. The screw speed is steplessly adjustable from 0 to 38 r.p.m. and the plasticating capacity of the unit is 660 lb. per hour. Maximum clamping capacity and stroke are 2500 tons and 71 in. respectively. Maximum daylight is 126 in., and minimum mold thickness without spacer is 55 in.; 23⅝ in. with a 31½ in. spacer. Platen area will accommodate molds up to 82$^{11}/_{16}$ by 53$^{9}/_{16}$ in. across. Unit is designed with a heater capacity of 120 kw., a 150-hp. motor, a hopper capacity of 220 lb., and the overall floor dimensions are 53 by 15 feet. Three different interchangeable screw heads are also available. *Meiki Co. Ltd., 1,2-Chome, Shioiri-Cho, Mizuho-Ku, Nagoya, Japan.*



(More on page 52)

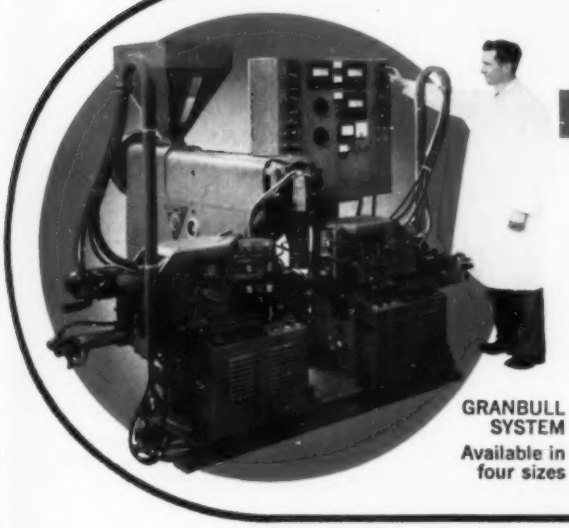
Years Ahead!

PRODEX HIGH TORQUE EXTRUDERS with CHANGE GEARS



now permit you to select quickly the optimum reduction ratio and screw speed necessary to extrude **either high or low viscosity materials** at maximum horsepower efficiency and highest possible production rate for each extrusion job.

Prodex extruders give you the best possible machine return on your investment of any extruders in the world today. These machines are built vented or non-vented in a complete range from 1¾" to 10".



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For small parts—up to 2 gal.—a toggle clamp mechanism is used to develop high pressures and high speed action. A continuous parison flow from a single head feeds up to four mold clamps, resulting in extreme uniformity of parts. The highly streamlined head permits use with all polymers, including rigid PVC.

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Prodex blow molders, for maximum output and reliability of operation, are supplied with specially designed, high-performance **Prodex extruders.**

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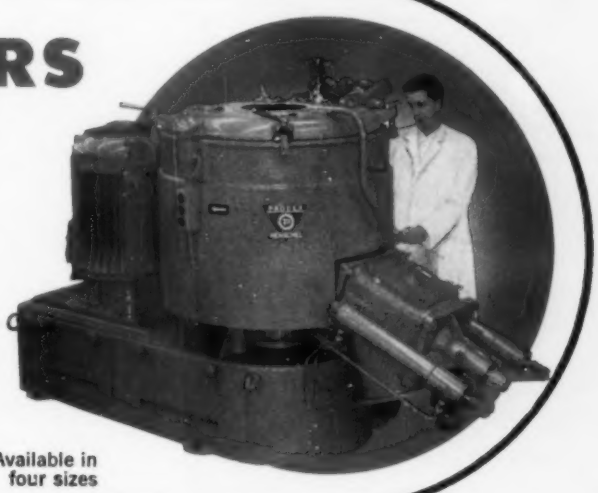

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(From page 50)

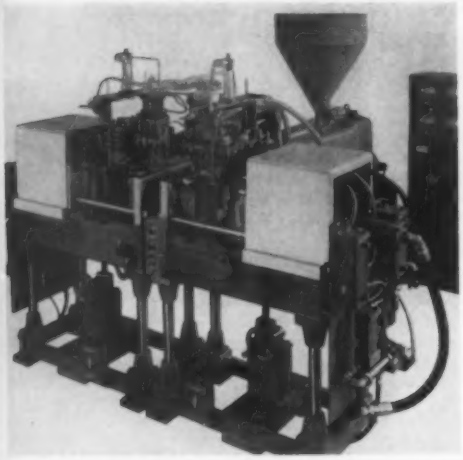
Premix press

This 350-ton HPM downward acting hydraulic press was especially designed for the molding of reinforced plastics premix. Equipped for semi-automatic operation, it is fast closing, has automatic mold slow-down, and accurate speed and pressure control. The press has a 24-in. stroke; maximum mold mounting space of 36 by 48 in.; and a 54-in. daylight opening (platen to bed). It is completely self contained and powered with a 60-hp. motor. For safety, the moving platen cannot drop at the end of the automatic cycle when the selector is on manual; when the up-down switch is not depressed; during power failure; or when the shut-off safety stop is depressed. Lower limit of the platen travel is protected by a stop built-into the ram and cylinder assembly. *HPM Div., Koehring Co., Mt. Gilead, Ohio.*

Gel-coat spray system

For use in the manufacture of boats and other applications, this polyester gel-coat spray system consists of a catalyst tank, resin tank, spray gun, respirator, and the necessary hoses, regulators, and fittings. A conventional gun sprays the resin and is fitted with a side injector nozzle to mix catalyst with the resin. Only one material control is required with the system. The single control maintains constant equal pressure on both catalyst and resin feed tanks. Fixed spray-nozzle orifices dispense the proper proportions of catalyst and resin at any pressure adjustment. This control permits the user to lengthen or shorten gel-coat cure times by altering the amount of catalyst dilution without changing tank pressures. *Binks Mfg. Co., 3140 Carroll Ave., Chicago 12, Ill.*

Blow molders with precise parison adjustment



PRODUCTO Versa-Blow blow molder has precision adjustable base for the parison alignment.

Through the use of building block construction, eight different models of Versa-Blow blow-molding machines are offered including 1-, 2-, 4-, and 8-parison head arrangements. Units with capacities to mold products such as 80-gal. drums are available. Each model has 3-way micro-adjustments for centering molds under the parison; positive, high-speed equalized opening and closing; horizontal in-line accumulators; head adjustments to regulate parison weight, concentricity, and straightness; adjustable platen daylight; and hard chrome-plated head channels and design to provide dead-spot free operation. Details of the eight models are shown in the table. Two other models are available; specifications on request. *Plastics Machinery Div., The Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.*

Planetary mixer

Suitable for the preparation of resin pastes and dry blends, this double planetary changeable can mixer comes in 8-, 12-, and 20-gal. sizes with dispersion type stirrers and simplified hydraulic stirrer lowering and raising device. Stirrers can be tilted back for removal of the can and clean-up. The blades of the stirrers rub close to each other and the sides of the can to develop tremendous compressive and shearing action in the heaviest pastes. Standard units are provided with variable speed drives; vacuum covers and jacketed cans are optional equipment. *Charles Ross & Son Co., 148-156 Classon Ave., Brooklyn 5, N. Y.*

Film sealers

Suitable for sealing polyethylene and other thermoplastic films, the Model 16T thermal impulse sealing machines are designed for bench mounting. Foot operated, the sealers are available in 16-, 24-, and 30-in. seal lengths. The rapid heating effect is achieved by pulsing a thin ribbon of high-temperature alloy with a high current. When the current flow ceases, the low thermal capacity of the alloy ribbon reverses the heat flow and rapidly cools the seal. *Weldotron Corp., 841 Frelinghuysen Ave., Newark 12, N. J.*

Reciprocating-screw injection machine

A complete line of the familiar Ankerwerk reciprocating screw injection machines, including sizes from 2 through 6, 12-, 32-, 60-, and 120-oz., is now available in the U. S. from the sales agency listed below. Because of the excellent mixing action of the rotating screw, the machine is particularly good for the molding of such materials as polycarbonates, rigid vinyls, and other heat-sensitive materials. The mixing action promotes heat transfer and increases the injection cylinder efficiency. *Ankerwerk International, 1229 E. Wakeham Ave., Santa Ana, Calif., or 2 Hamilton St., Bound Brook, N. J.*

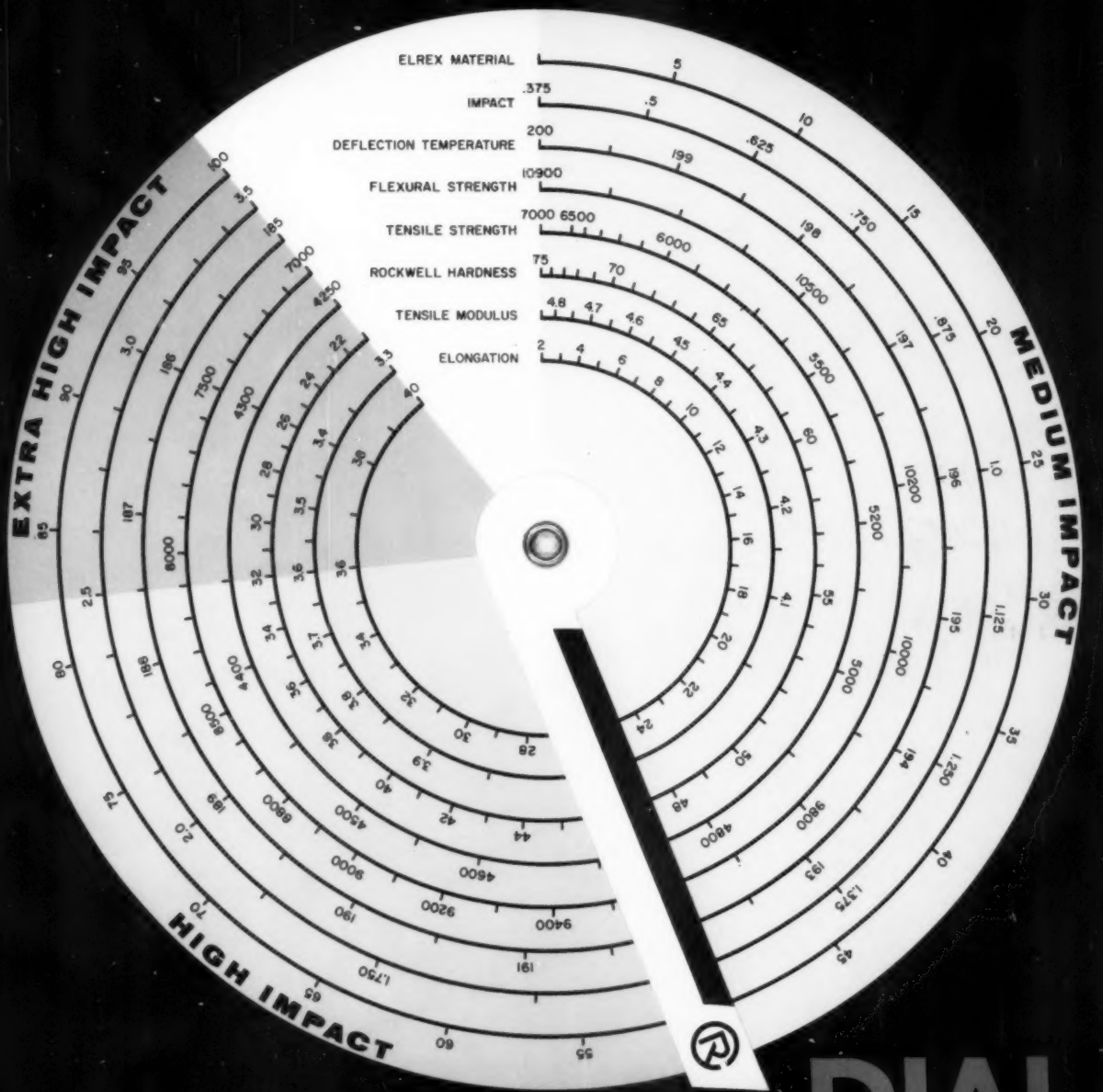
(More on page 55)

Specifications: Producto blow-molding machines

	Model No.[a]			
	VD-1	VD-2	VD-3	VD-4
Platen size, in.	11 by 21	11 by 21	14 by 25.5	14 by 25.5
Clear platen width, in.	15.5	15.5	20	20
Height adjustment, in.	8	8	12	12
In-out adjustment, in.	1.5	1.5	1.5	1.5
Side adjustment, in.	1.5	1.5	1.5	1.5
Platen daylight adjustment, in.	3	3	3	3
Stroke, in.	11	11	11	17
Centerline accumulator to floor, in.	64	64	78	78
Double-head center distance, in.[b]	7.25	7.25	9.25	9.25
Maximum clamping force, lb.	10,000	17,000	17,000	28,000
Minimum mold thickness, in.	9.5	9.5	9.5	15.5
Maximum platen daylight, in.	23.5	23.5	23.5	35.5

[a]Single-station models, VS-1, VS-2, VS-3, and VS-4 have same specs. [b]Not applicable to single-head machines.

NOW A complete range of impact polystyrene, graft copolymers



Properties shown here are typical values. Individual product specifications are available. Property testing procedures are listed on reverse page.

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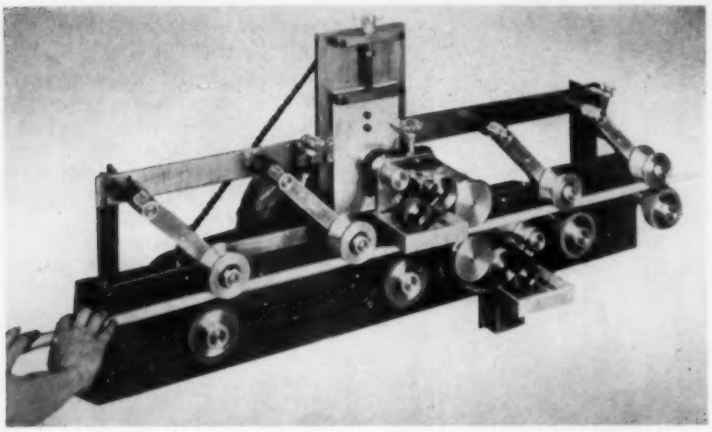
TEST METHODS USED IN NOMOGRAPH DATA PREPARATION

PROPERTY	UNITS	ASTM Test Method
Izod Impact ⅛" x ½"	Ft. lb. per in. notch	D-256-56
Tensile strength	psi	D-638
Elongation	%	D-638
Tensile modulus	psi	D-638
Flexural strength	psi	D-790
Hardness	Rockwell "M"	D-785-51
Deflection temperature under load*	°F at 264 psi fiber stress	D-648-56

Data given are for high heat material. Conventional resins are constant at 175° F.

NEW MACHINERY-EQUIPMENT

(From page 52)



Industrial marker

Dual flexographic inking systems on this manually fed tube or rod marker make possible the printing of clear, blur-free imprints on rigid or semi-rigid plastic tubes and rods. The unit can handle ⅜ to 3 in. tubing and can be altered to suit other sizes. Average output is 2 to 3 tubes per minute depending on tube size and handling. Tube is inserted between rubber drive roller and centering pressure roller, which feed the tubing past the flexographic units. After imprint is placed on top and bottom of tube, the printed tube is ejected. *Industrial Marking Equip. Co., 655 Berriman St., Brooklyn 8, N. Y.*

RP spray-up unit

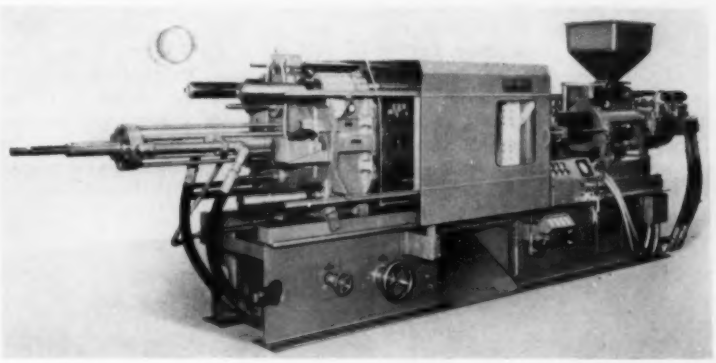
An hydraulic road trailer has been developed for in-the-field application of fibrous glass-reinforced polyester or epoxy resins to swimming pools, buildings, boats, etc. Supplied as a complete system, it has a self-starting, battery-operated compressor, a two-pot resin unit, a complete catalyst-injector gun system with its own pressure pots and cleaning system, and is delivered with a supply of raw materials. A free-swinging boom gives the gun a 30-ft. spraying radius. A glass chopper ejects either short lengths or continuous strands. Production rate with three 60-end rovings is about 9½ lb. of laminate per minute. *Spray-Bilt Inc., 3605 E. 10th Court, Hialeah, Fla.*

Dry blender

Suitable for the addition of plasticizers to finely divided PVC resins in the preparation of dry blends, the Verticone can be used to add liquids to powdered materials and will handle solids flows from 150 lb./hr. to 150 tons per hour. In operation, the powdered material must be fed to the unit at a uniform rate (± 5%) onto a cone in the top of the unit. The cone channels and distributes the material into a falling curtain. As the material leaves the periphery of the cone, spray heads introduce the liquid component of the mix in the desired ratio. At solids rates under 500 lb./hr., the precise addition of liquid becomes difficult due to poor control of low liquid flow rates. In these cases batch procedures can be used to maintain accuracy. Housing, feed, and drive are available in carbon steel or other prescribed materials. *The Johnson-March Corp., 3018 Market St., Philadelphia, Pa.*

Injection presses supplied to suit application

By using modular construction, the four models of the newly redesigned Reed-Prentice injection machines have interchangeable mold clamping systems and injection units which make it possible to have 12 different arrangements, each providing the exact combination of clamp tonnage and injection capacity required for a specific application. Also included in the new design is the hydraulic mold set-up and spacing system. Other major specifications of the new models are listed in the accompanying table. *Reed-Prentice Div., Package Machinery Co., East Longmeadow, Mass.*



Specifications: Reed-Prentice presses

	275TC	*350TC*	*350TCL*	*450TC*
Shot size, oz.	8/10	12/16	12/16	18/24
Plasticating capacity, lb./hr.	120	150	150	200
Rate of injection, cu. in./min.	968	1360	1360	1420
Mold clamping stroke, in.	6.25 to 11.5	7.25 to 14.5	8.5 to 20.25	6 to 22.625
Platen size, in.				
Horizontal	27	32.5	32.5	40
Vertical	27.25	32.5	32.5	40
Max. mold size, in.				
Horizontal	16.5	32.5	32.5	40
Vertical	27.25	20.5	20.5	26
Space between tie bars, in.	16.5	20.5	20.5	26
Projected casting area, sq. in.	138	178	186	240
Dry cycle time, sec.	6.37	6.76	7.75	10.18
Standard motor hp.	40	40	40	50

(More on page 56)

NEW MACHINERY-EQUIPMENT

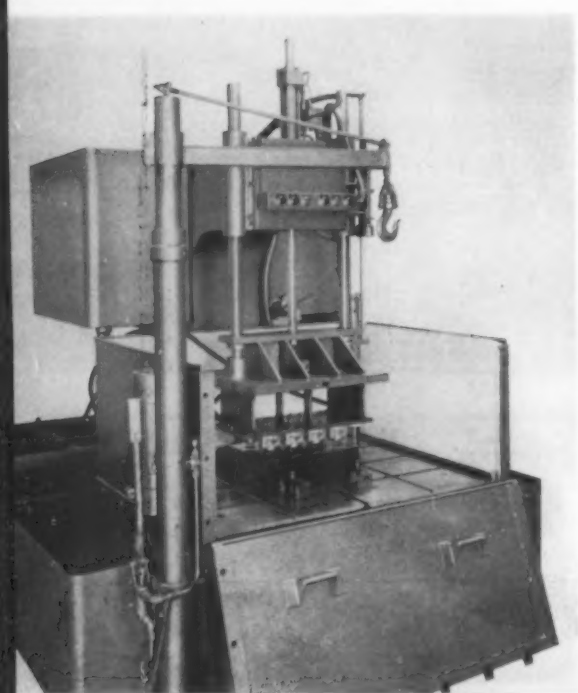
(From page 55)

Injection machine

Designed for the production of small thermoplastic parts, the Arburg injection-molding machine has a ⅛-oz. shot capacity and an air operated injection plunger capable of exerting 7500 p.s.i. on the material using a shop air supply of 100 p.s.i. Equipped with a 110-v. a.c. heater system, the unit can be operated semi- or completely automatic at rates over 400 shots/hr. using a safety device to insure ejection of prior shots. Material cylinder has a spirally channeled bore to increase the efficiency of heat transfer. Unit uses 3- by 4-in. molds and clamping can be either vertical or horizontal. A needle shut-off valve in the nozzle eliminates drooling with low-viscosity melts. Press is mounted on compact, portable, lightweight base made of forming tube. *Arburg of America, 1225 E. Wakeham Ave., Santa Ana, Calif.* →

Electrical discharge machine designed for large work

Molds up to 3 by 4 ft. in size can be handled in the Die-Matic electrical discharge metal-cutting machine. Reportedly the largest electrical discharge machining unit available, it can remove metal on roughing cuts at the rate of 6 cu. in./hour. Cutting electrodes as heavy as 500 lb., as well as fine electrodes no larger than 0.005-in. in diameter, can be used. Ratio of metal-to-electrode wear in the roughing operation ranges from 30:1 to 50:1. The operation is fully automatic, and the unit can be run unattended on both roughing and precision finishing cuts; one man can attend to four machines. Standard work tank has a 200-gal. capacity, and the portable dielectric supply tank holds 800 gallons. Size of the T-slotted electrode platen is 18 by 24 in.; travel of the platen is 18 in. vertically with a 30-in. gap between the top of the work tank and the bottom of the platen. *Easco Products, Box 587, Ypsilanti, Mich.*



EASCO electrical discharge metal-cutting machine with front of the cutting chamber removed to show work mounting table. In operation, the cutting chamber is filled with dielectric oil. Hoist comes with machine for the handling of large work pieces.

Monofilament sample extruder device

Called the Tinius Olsen Monofilament Tester, this device is essentially a miniature monofilament production line, which will produce samples of monofilament of thermoplastic materials for property evaluations. Using less than 10 g. of resin, the unit will extrude and orient about 30 yd. of 0.010-in. monofilament in about 20 minutes. Temperature of the ram extruder can be set at values up to 600° F. with a ±0.4° F. accuracy. Extrusion pressure is controlled by placing up to 100 lb. of weight on the extruder ram. Godet rolls, which operate with a speed differential, are used to orient the filament after it has been extruded and cooled in a water bath. The unit provides close control of both melt temperature and pressure, and is designed for use with readily interchangeable, inexpensive, extrusion dies. *Tinius Olsen Testing Machine Co., Easton Rd., Willow Grove, Pa.*

Blow molder

Designated Model 100, this two-station blow-molding machine is supplied complete with manifold and dual head flow valve. Also included are 2 air-operated clamp assemblies and a 2½ in. extruder with an L/D ratio of 20:1 having a minimum capacity of 120 lb./hr. of polyethylene. Platens have a daylight opening of 24 in. and will accommodate parts up to 50 in. long and 10 in. in diameter. Clamp force is 3 tons, and the machine will dry cycle at rates of 1500 cycles per hour. The extruder barrel is of one-piece construction with an Xaloy liner. A choice of either mica band or cast-in aluminum heaters is available. Extruder cooling consists of cooling coils grooved into the barrel. Approximate delivery time after place of the order is 3 to 4 weeks. *Quality Machine Co., 1840 Givan Ave., Bronx, N. Y.*

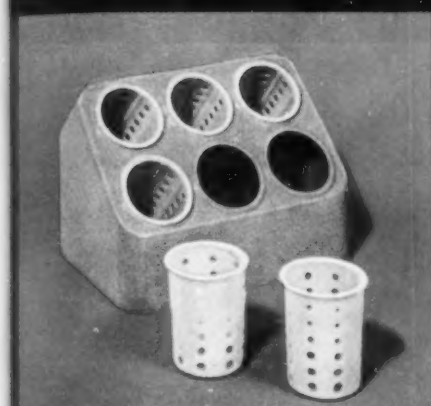
Foam cutter

This hot-wire cutter for expanded polystyrene and rigid or flexible urethane foam can handle foam billets as large as 4 ft. wide by 16½ ft. long by 16¾ in. thick. Cutting wires can be positioned for simultaneous horizontal and vertical cutting. Cuts to an accuracy of 0.015 in. are produced. Power of 220 or 440 v. can be used for the wire cutters. The voltages are stepped down through the use of transformers regulated with powerstats. A maximum of 125 cuts per pass can be made with the cutter. *Dura-Tech Corp., Boca Raton, Fla.*—**End**

DEGREASING BOX (W. D. Adam Co., Los Angeles)—Rugged, light, and durable. Unaffected in normal cleaning with degreasers like Trichloroethylene . . . won't corrode.

INPLANT STORAGE (Como Plastics, Columbus, Ind.)—Designed for food industry . . . injection molded, 18-gal. container that's easily washed and easily sterilized.

MILK CASE (St. Regis Paper, Panelyte Div., N.Y.C.)—Weighs only 4¾ pounds: tough and durable, non-absorbent, and odor free . . . designed for safe stacking.



CUTLERY CANISTER (Bloomfield Industries, Chicago)—Lightweight, and unaffected by harsh detergents and boiling water. Shown with counter holder also made of MARLEX.

Tote . . . ship . . . store . . . trust MARLEX* to do the job better!

Today, an increasing number of special and multi-purpose tote boxes, storage and shipping cases, containers, and the like are being made of MARLEX. This versatile, high density plastic offers outstanding performance at low cost for these applications in every walk of industry and commerce—light and heavy manufacturing, food processing, hospitals, transportation, wholesale and retail delivery.

Producing these items from MARLEX high density polyethylenes or ethylene copolymers is also economical—they can be injection molded, thermoformed, blow molded, or fabricated from stock. Moreover, this tough and durable plastic is lightweight . . . resistant to acids, alkalies, oil, greases, biological rot and corrosion. It withstands temperatures from –180°F to 250°F and can be steam sterilized. It is non-allergenic . . . dent-proof, crack resistant, and virtually indestructible. For further details on MARLEX, contact the nearest office listed below.

*MARLEX is a trademark for Phillips family of olefin polymers.

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PICKING BOX (Pioneer Products, Tucson, Ariz.)—Lightweight, non-absorbent, nesting and stackable . . . resists denting, won't crack. MARLEX means low cost and longer life.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma, a subsidiary of Phillips Petroleum Company

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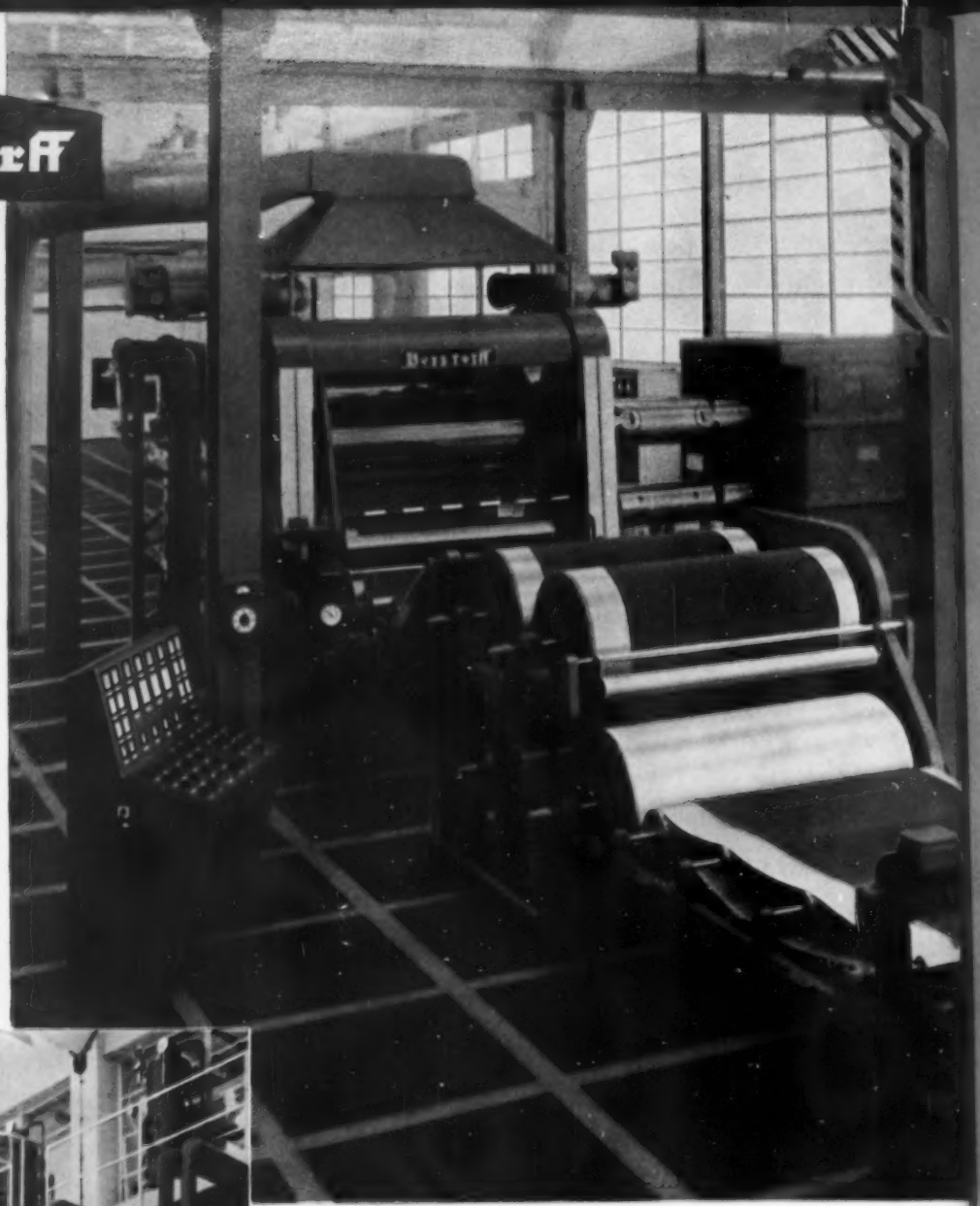

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individual drive to each
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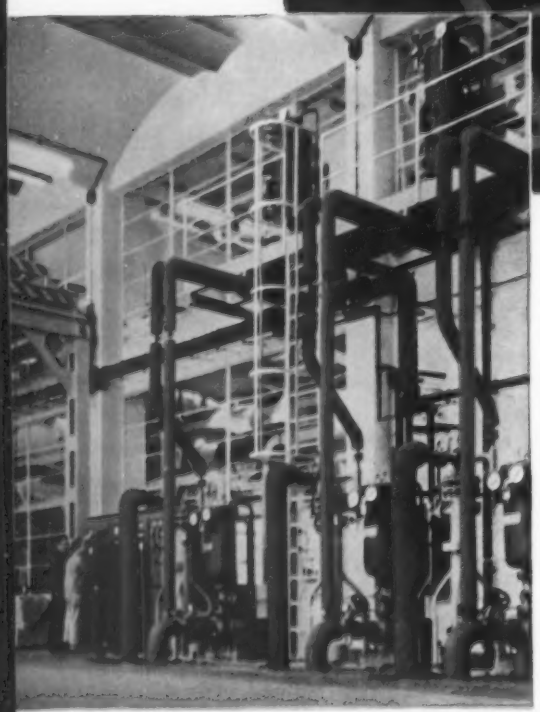
Axis crossing mechanism
for the fourth roll.



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with electrode heating.

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LETTERS TO MODERN PLASTICS

Out of the dynamics of the plastics industry comes a wealth of new ideas, exciting concepts, sharp criticisms, and constructive thought. And this is the essence of the letters that cross the editors' desks daily. Here, in keeping with the spirit of the "Wide World of Plastics" and the various international exhibitions and conferences taking place this year, is a sampling of some of the significant contributions culled from our bulging mail bags.

U. S. tariffs—views of a European producer

Sir: We have seen the article on p. 90 of your Dec. 1960 issue, referring to the coming GATT negotiations, and, in particular, to their possible effect on U. S. plastics producers and their markets. It is interesting to have the trans-Atlantic view on these matters, but we would like to take issue with you on a number of points.

In the first place, this is a question complicated by political and by various other pressures, but we would point out that, in implying that U. S. industry is likely to suffer seriously from reductions in the U. S. tariff on plastics, you are really distorting the facts. Table I shows the tariffs on the four major thermoplastic materials into the countries chiefly concerned in world trade in these materials: The U. S. combined specific and *ad valorem* tariffs have been turned, for comparison, into *ad valorem* duties on the basis of current valuations. This table shows clearly that, in plastics raw materials, the effective U. S. tariff is higher in every case than existing and future tariffs in the major European markets. The outside world, therefore, has every justification for asking for a reduction in the U. S. tariff on plastics raw materials without reciprocal reduction on their own tariffs. One of the chief sufferers is the U. S. plastics molder and fabricator who is being prevented by these very high tariffs from purchasing his raw materials in a competitive world market: diminishing thereby his potential export business. Thus, the total exports from the U. S. of plastics toys, manufactured plastics products, and parts is about one-tenth that of the total plastics material exports. It is surprising that the U. S. molder and fabricator has accepted this situation for so long.

That the U. S. tariff is an effective barrier for the protection of U. S. producers is shown by the figures in Table II—these are taken from the OEEC Statistical Bulletin for 1959. Under Item 599.01, Synthetic Plastics Materials, the noted trade (in 1000 U.S. dollars) took place: Of total U.S. exports, 34% went to the U.K. and EEC (the other main plastics producing area in the world), whereas of total U. K. and EEC exports, a mere 2.5% went to the United States. This is surely indicative that the U. S. industry has some small degree of protection!

The figures show conclusively that the U. S. is able to compete effectively in world markets and that U. S. plastics producers should refrain from hiding behind tariffs that are two, three, or even four times as high as those of the United Kingdom or EEC countries.

The U. S. plastics industry is now, we believe, sufficiently advanced not to require protective duties for the succor of an 'infant industry,' and the other world producers are ready and able to compete effectively in all countries, including the U. S. In these troubled times, the Free World can benefit greatly from Free Trade, and the Free World includes, we would hope, the U. S. As far as plastics are concerned, the U. S. tariff is one of the chief barriers to Free Trade and for the U. S. tariff, the U. S. plastics producers are responsible.

We will be interested to see if you venture to publish this letter, and, although we realize we may have stuck our heads into a hornet's nest, we feel that something should be said

Table I: U. S. tariffs on plastics raw materials, compared with European producers

	U. S.		U. K.	France	Germany	Italy	Benelux	Eventual EEC
	Actual	Ad. val.						
Polyethylene	3.4c. + 25½%	39%	10%	23%	15%	23.7%	6.9%	16 to 20%
PVC	2.5c. + 12½%	27%	10%	24%	15%	20%	6.9%	16 to 20%
Polystyrene	3.5c. + 22½%	42%	10%	25.8%	14%	20%	6.9%	16 to 20%
Acrylic sheet	21c	28%	10%	24%	14.8%	23.9%	8.6%	16.8 to 21%

Table II: U. S. exports of plastics materials, compared with other world producers[a]

↓ Importing ← Country → Exporting	U. S.	U. K.	France	Germany	Italy	Benelux
U. K.	23,582		2,246	14,527	1,661	3,191
France	8,325	5,259		9,830	738	2,407
Germany	18,151	4,237	4,212		4,959	4,070
Italy	12,564	4,344	1,228	12,371		1,121
Benelux	30,633	10,041	6,277	23,995	2,021	
Total EEC	69,673	23,881	11,717	46,196	7,718	16,195
U. S.		1,999	570	5,394	2,416	280
Japan	32,935	1,973	—	4,766	310	622
British Commonwealth	66,844	44,883	1,274	13,038	2,382	1,882
Total exports[b]	**271,208**	**125,451**	**38,004**	**168,658**	**29,425**	**38,015**

[a]Figures in 1000 U. S. dollars. [b]Including exports to nations not listed.

LETTERS (continued from page 59)

in a U. S. publication for the plastics manufacturers outside of the United States.

J. C. Swallow,
Chairman
Imperial Chemical Industries Ltd.
Plastics Division
Welwyn Garden City,
Hertfordshire, England

Plastics for agriculture

Sir: The plastics industry has practically no data on product characteristics in the environment imposed by agriculture, makes no effort to develop outlets in this field, and has no awareness of the dollar potential of this market. You implied this in your Editorial Comment in the Jan. 1961 issue of MODERN PLASTICS: "No one has ever estimated the capacity of the plastic industries . . . But when overcapacity is allowed to dominate the sales scene, pressures on prices and profits become disastrous, leading inevitably to less money being available for *research and development.*"

The validity of your statement is demonstrated by the fact that we, as commercial hydroponic crop growers, were forced to do agricultural-plastics research and development . . . and then had to manufacture plastic growing equipment, literally 'with our own hands.' Over three years ago it became increasingly apparent that new commercial hydroponic growing equipment was a must: to eliminate or overcome the deficiencies of existing hydroponic systems, and to satisfy the increasing demand for new systems. While the exact configuration of the equipment was undetermined at that time, we recognized that the optimum growing equipment would have to be modular, lightweight, resistant to chemicals, environmentally stable, and highly flexible in use. Plastics, of course, were the obvious solution.

Crop growing, regardless of the means used, is a science. Most improvements in equipment, fertilizers, and techniques have come about through cooperation between the manufacturers and the growers. This is not true in the plastics industry. Lack of technical know-how and obvious disinterest in the needs and scope of the agricultural market were made apparent to us by the plastics industry. Among the polyvinyl chloride extruders and distributors, in particular, there was marked technical incompetence as well as reluctance to quote prices compatible with an Original Equipment Manufacturer cost structure. In fact, retail prices were generally lower than those that were quoted by the manufacturers and suppliers!

Since the need for improved commercial hydroponic growing equipment was so great, we had to take over where the plastics industry fell down. Obtaining most of our plastic knowledge from your excellent *Modern Plastics Encyclopedia* issues and by a trial-and-error process, we developed an all-plastic hydroponic growing system. The costs we incurred from initial development through final productizing were far in excess of what they would have been if we had been working with cooperative and progressive manufacturers and suppliers in the industry.

A working agricultural showcase containing growing equipment made of polyvinyl chloride pipe and fittings, polystyrene containers, and polyethylene weather shielding has been in operation for the past year. The system has received agricultural recognition from some of the best agronomists in Florida. It produces a greater yield of superior crops in minimum space and with less effort than has heretofore been achieved by any growing method or system. These are the significant highlights from an agricultural point of view. More details about the equipment were published in an article in the March issue of *Florida Grower and Rancher.*

Now, about the amount of plastics used. The data in the accompanying table cite the figures for a 60- by 60-ft. operation (1300 tomato plants) and extends these figures to an acre (about 20,000-plant capacity).

Successful growers are those who take advantage of every possible agricultural advance . . . and our all-plastic equipment meets the growing needs of a large number of farmers. To the plastics industry, it could represent a new and great market with high dollar potential.

To achieve compatibility between the needs of the commercial growers, and a means of supplying them, requires a capability that we must attain. This imposes three requirements: ethical, progressive suppliers with a realistic price setup; fabricators with proper qualifications and facilities; and, above all, a sensitivity on the part of the plastics industry to changing times, methods, equipments, as well as markets.

Ben Silverman
Dunedin, Fla.

Amount of plastics used in the hydroponic growing of tomato plants at a Florida farm

Material used	*1300 plant capacity (60 by 60 ft.)*	*20,000 plant capacity (1 acre)*
Polyvinyl chloride		
1¼-in. pipe	1,500 ft.	25,000 ft.
½-in. pipe	1,400 ft.	23,250 ft.
1¼-in. elbows	250	4,150
½-in. elbows	1,400	23,250
½-in. couplings	1,300	21,580
Polystyrene containers	1,300	20,000
Polyethylene weather shielding	8,000 sq. ft.	50,000 sq. ft.

Blow-molded toys

Sir: By this time you must have heard of the customers' bad reaction to all blown toys. I have written to both the Toy Association and S.P.I. requesting that they form a Blow-molders Division.

There have been half a dozen failures by companies engaged in blow molding of toys since the first of the year. Only the companies managed by men who will change their ways will be able to survive. Making merchandise larger and larger, thinner and thinner, and finished worse and worse all of the time has been the policy. No junk will stand up long under consumers' hard usage.

If blow-molded toys are to stay on the market, they must be made better looking. The thickness of the walls must be suitable for the use employed. The article must be engineered properly for its end use. We have kept blow-molded items quality articles for more than 40 years. If they are no longer kept quality articles, they cannot survive.

Our customers never heard the words "blow molding." We found that customers were only interested in whether or not the item would sell over the counter and whether or not they could make a profit on it. How we manufactured it was our business.

Customers now look at the item and ask whether or not it is blown. If you advise that it is blown, they tell you that it could not possibly be good. You can't possibly dis-

agree with them after you have spent some time examining the items that are on the market. Ninety percent of them are just junk. They are poorly molded, have poor finish, and they are a disgrace to both the toy and the plastics industries. This is just a repetition of what has happened to styrene toys, until they were replaced by polyethylene.

Irwin Cohn,
President
Great American Plastics Co.
Nashua, N. H.

More encyclopedias needed

Sirs: In your next issue of MODERN PLASTICS we would appreciate your calling attention to the very great need at L. A. Trade Tech for recent past editions of the *Modern Plastics Encyclopedia*. Since the S.P.I. Vocational Training Program at Los Angeles Trade Tech is a new undertaking, material from previous years' classes is not available to the students. If your readers would like to forward the encyclopedia directly to the class, it can be addressed to: Prof. Victor Keller, Los Angeles Trade Technical College, 400 W. Washington Blvd., Los Angeles 15, Calif.

Both the students and Prof. Keller, as well as those of us on the S.P.I. Committee, will appreciate very sincerely such assistance to obtain this necessary literature.

David Rome
Olympic Plastics Co. Inc.
Los Angeles, Calif.

Extruding PP films

Sir: Let me congratulate you on the excellent article, "Extruding polypropylene films," by A. R. Gilden and W. J. G. McCulloch, which appeared in the July 1960 issue of MODERN PLASTICS.

Behind this article is evidently a high-quality statistical effort which is difficult for an editorial board or a general reader to grasp. Nevertheless, the timeliness and importance of the subject (what is more important in plastics than the appearance and visibility characteristics of an important plastic?) make its inclusion in an issue of your magazine desirable.

Similar experiments with plastics are currently being carried out at the Bureau of Mines.

Roy L. Grant,
Chemical Engineer
U. S. Bureau of Mines
Pittsburgh, Pa.

Updating ceramoplastics

Sir: In the 1961 Edition of *Modern Plastics Encyclopedia*, on p. 229, there appears an article entitled "Inorganic Plastics," which deals exclusively with glass-bonded mica and ceramoplastic. As the world's largest manufacturer of these materials and of Synthamica synthetic mica, we at the Mycalex Corp. of America were surprised to note that the information contained in this article was considerably out-of-date.

There have been on the market for some time new ceramoplastic formulations which exhibit improved properties, particularly thermal endurance. While it is true that your article alluded to new materials which may be used at temperatures up to 950° F., a detailed description of such a material was completely missing. We believe that you are therein referring to Supramica 560 ceramoplastic, which is a precision-molded ceramoplastic wherein there is a special glass binder that bonds not only mica particles but also a secondary crystalline phase which precipitates from the reaction product of potassium silico fluoride and alumina. This material, a Mycalex Corp. exclusive, which is the subject of U. S. Patent No. 2,897,573, has very low glass content and exhibits good moldability and excellent thermal endurance.

In addition, no reference whatsoever was made to the Mycalex Corp. of America's new Supramica 620 ceramoplastic, which is a sheet material exhibiting excellent electrical properties at high temperatures up to 1500° F. This material has been on the market for approximately a year, and we feel strongly that this valuable new tool should have been mentioned in any comprehensive article on inorganic plastics.

We also feel we should bring to your attention the fact that we now have in a stage of final development a new precision-moldable ceramoplastic, called Supramica 620BB ceramoplastic, which is similar to our Supramica 620 compression-moldable ceramoplastic. Supramica 620BB ceramoplastic is compatible with metal inserts and has a coefficient of thermal expansion of the same order as our heretofore known Mycalex and Supramica materials. This material will withstand temperatures of the same order as the Supramica 620 ceramoplastic sheet, and will have excellent electrical and mechanical properties at these elevated temperatures. Complete data on this material are available for those who wish to write for it.

In order to give a full picture of the new improved high-temperature ceramoplastics we present in the accompanying table the properties of Supramica 560 precision-molded ceramoplastic, and Supramica 620 compression-molded ceramoplastic.

We trust that you will bring to the attention of your readers this up-to-date information as we consider it vital to them.

A. S. Backus,
Vice-Pres., Operations
Mycalex Corp. of America
Clifton, N. J.

For research by molders

Sir: I have read with interest your editorial in the April issue entitled "Processing research needed." It brings out a very great weakness in the plastics molding industry.

When a plastic molder gets started, he relies heavily on technical information concerning the materials and

Properties of Supramica 560 and Supramica 620

Property	*Precision-molded Supramica 560*	*Compression-molded Supramica 620*
Electrical		
Dissipation factor, 1 mc.	0.0020	0.0015
Dielectric constant, 1 mc.	6.7	7.2
Loss factor, 1 mc.	0.013	0.011
Dielectric strength, v./mil	350	250
Arc resistance, sec. (A.S.T.M. D495-58T)	250	300
Mechanical		
Specific gravity	2.7	3.2
Impact strength (Charpy), ft.-lb./in. of notch	0.4	0.5
Water absorption, % in 24 hr.	Nil	Nil
Flexural strength, p.s.i.	12,000	10,000
Modulus of elasticity, p.s.i.	8×10^6	12.5×10^6
Compressive strength, p.s.i.	25,000	35,000
Tensile strength, p.s.i.	4,000	5,000
Maximum operating temp., °F., continuous	932	1,550
Thermal conductivity	0.0015	0.0012
Thermal expansion	11.3×10^{-6}	11.6×10^{-6}

processing methods of such materials supplied by the raw material makers. Certainly the raw material suppliers have done quite a bit of research and development work on their own materials, and such information is very valuable to the plastics industry. However, this is only part of the information needed to provide customers with good plastic products at reasonable prices.

The molder is so much closer to the end use of his molded parts that he should take the responsibility for doing considerable testing of his molded materials to determine their suitability to the application and to develop better materials or combinations of materials. By experimenting to determine how various plastic materials work on the same application, the molder can select the best material for the job. By so doing, he can prevent product failures which give both him and the plastics industry a black eye.

Particularly in the reinforced plastics field have we noted over the past 13 years many cases where a molder had attempted to sell a product that was not suitable for the application, either economically or physically. After many months of disheartening work, both the molder and the customer have lost tremendous amounts of money and time and each has blamed the other. We have seen many molders go out of business under such circumstances.

If the molder and the customer had done more testing and knew far more about the material, both of them would have saved this terrific loss. Too often a molder is so anxious to get a new job going that he wishfully convinces himself that the application is sound. The new molder, looking for business, is far more likely to have the difficult marginal jobs sent to him for quotation and is far more likely to accept such jobs than is an established experienced molder.

The Molded Fiber Glass Companies research and testing budget runs over $150,000 per year. This does not include any product development work. We do research work in resins and other materials as well as on finished products.

Our department heads are very active in ASTM reinforced plastic work, because they realize how little is known and how much should be known about what fibrous glass-reinforced plastic will do and will not do. I believe every plastic molder should have at least a testing laboratory equipped to make all the normal physical tests used in preparing specifications for his material, and also should have whatever specialized testing equipment needed to determine whether or not his product is suitable for the applications he sells.

In addition to testing and materials research, process and equipment engineering, experimentation, and development are also areas in which the average molder relies too heavily on the equipment supplier and the raw material supplier. If the plastics industry is to realize its full potential, increased plant efficiency and better quality control are both needed. We at Molded Fiber Glass have prided ourselves on our polyester resin plant, preform machines, and our presses, but we have neglected until now an area in which tremendous amounts of labor are involved. That area is in finishing, fabrication, assembly, and painting.

We are doing considerable work, which might be called research, on developing new equipment and improving existing equipment to do these jobs better and at considerably less cost. We have scrapped hundreds of thousands of dollars worth of equipment less than five years old. We believe that the plastic molder, being closer to his problem than anyone else, is the one who should take the responsibility for developing and designing new equipment.

R. S. Morrison, Pres.
Molded Fiber Glass Body Co.
Ashtabula, Ohio

Army medicine needs help

Sir: Your publications have made our problem of obtaining information concerning plastics much simpler and far more effective. This information has helped many of our staff.

Our Resident in Dental Research and I are most interested in any plastics which have dental applications, i.e., use in a prosthesis, restorations, ion exchange, remineralization of calcified tissues, etc. Many other departments in our organization, such as Experimental Surgery and Space Medicine, are also interested. It would be greatly appreciated if you would keep us in mind if you find new developments which could be used in any of our endeavors. For those directly interested in our work, several brochures are available.

Warren R. Hester, Lt. Col. USAF (DC)
Chief, Clinical Dentistry Branch
School of Aviation Medicine
Brooks Air Force Base, Texas

About Sears' luggage

Sir: Your November 1960 MODERN PLASTICS certainly has been the topic of conversation among the various employees at our plant, and we must compliment you on the fine article, "Molded polypropylene: Sears' choice for luggage."

Your other articles, no doubt, are equally as interesting. However, A-1 Tool & Die Co. Inc. has played an important role in the luggage program for Sears, and, for this reason, we feel that an error in the article should be noted: A-1 Tool & Die Co. Inc. is located in Stone Park, Ill., and not in Youngstown, Ohio.

Woodrow J. Fischer
A-1 Tool & Die Co. Inc.
Stone Park, Ill.

Since this article was printed, we have learned that the vinyl handles for the luggage are molded by Gerber Plastics Co., 3001 Washington Ave., St. Louis 3, Mo.—Ed.

Let's make them safe

Sir: I am greatly disturbed by what appears to be an increased use of a very dangerous safety practice on certain injection molding machines. In these machines, one of the safety mechanisms (usually the hydraulic safety valve) is placed at the bottom rear edge of the safety gate and the gate holds the valve or switch in the "safe" position when the gate is open.

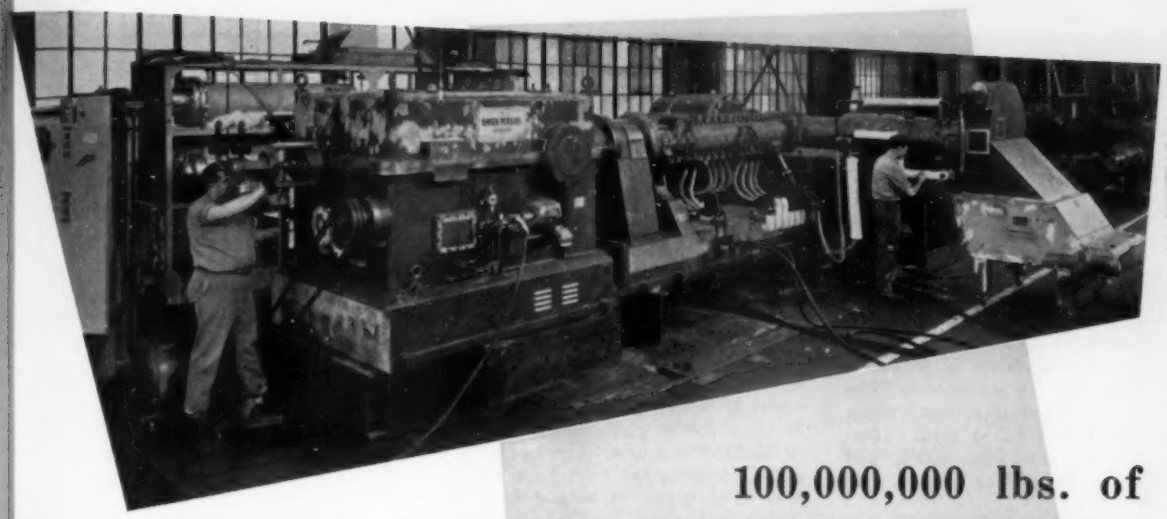
At a plant where I was formerly employed, an operator was killed by a press using the above design. Unknown to him, the gate came off the lower track and passed completely by the hydraulic safety valve without depressing it. Also unknown at the time was the fact that the electrical safety switch was inoperative. As the operator reached in to remove the part, the platen came forward again and he was severely crushed by 1500 tons locking force.

Press safety switches should be spring-loaded to return to the "safe" and not to the operating position. They should return to "safe" when the gate is opened only a fraction of an inch. Both electrical and hydraulic mechanisms should make the press "safe" even if the entire gate falls off the molding press.

For good safety practice, molding-room foremen should daily check the presses under their control by depressing each safety switch individually by hand. If the press operates when any one of the switches is in the "safe" position, the press should be immediately taken out of service until it is repaired.

Paul E. Schmidt
Standard Oil Co. (Indiana)
Research and Development Dept.
Whiting, Ind.

—End



100,000,000 lbs. of POLYOLEFINS PER YEAR WILL BE PRODUCED BY 10 CONTINUOUS PROCESSING LINES NOW BEING BUILT BY BAKER PERKINS

Now all the well known advantages of continuous processing have been adapted by Baker Perkins to compounding polyolefins and other plastics. The operation of each B-P processing line is fully continuous from the feeding of the polymers, pigments, stabilizers and other additives to the discharge of the dried pellets ready for bagging. Each line includes a Force Feeder, *a Ko-Kneader (List System) Continuous Mixer, *a Cross-Head Extruder, *a Hot-Cutting Unit, Water Cooling Trough, Dewatering Conveyor and *Heating and Cooling Unit for the Ko-Kneader and Extruder. Individual lines are designed for 750, 1800, or 3500 pounds per hour.

*These units are shown in top photograph.

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  Single floor installation
  Uniform power loads minimize electrical wiring requirements.
- Reduced Operating Costs
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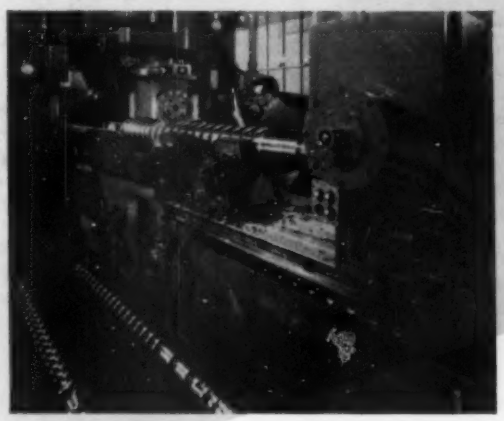
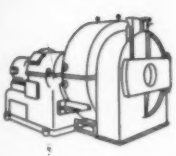
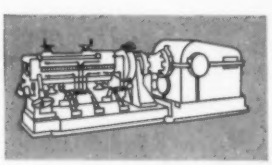
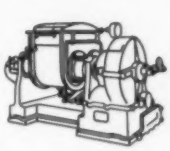


Modern equipment and skilled operators produce the precision components of Baker Perkins plastics processing lines. The operator in the photo above is machining a Ko-Kneader screw on one of the many special purpose machine tools in Baker Perkins shops. Extruder screws are also machined on this same machine. Exacting quality control is maintained in all manufacturing operations at Baker Perkins.

BAKER PERKINS INC.







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WORLD-WIDE PLASTICS DIGEST*

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

New specifications for polyurethane foam in upholstery. Brit. Plastics *34,* 73-74 (Feb. 1961). A new standard of the British Cellular Rubber and Plastics Manufacturers is presented. Pertinent data are presented to illustrate the most important requirements covering elongation at break, compression set, static indentation, and fatigue, as well as heat aging.

Radiation chemistry and polymer technology. S. H. Pinner. Brit. Plastics *34,* 30-34 (Jan.); 76-80 (Feb. 1961). The use of radiation in polymer technology is reviewed. Radiation is used to produce foamed plastics, to chlorinate hydrocarbon polymers, and to produce heat-shrinkable polyethylene. Many of the important patents in this field are classified by subject. The most important processes are also briefly described.

Materials

Gamma-ray induced grafting of some monomers onto natural silk and Capron. S. A. Azimov, Kh. U. Usmanov, N. V. Kordub, and S. I. Slepakova. Vysokomolekuliarnye Soedineniia *2,* 1459-62 (Oct. 1960). Acrylonitrile and styrene can be grafted onto silk and capron by irradiating the polymer immersed in a solution of the monomer. The optimal conditions for the grafting process are established. Analysis of the infra-red absorption spectra indicates that the CN-group is incorporated in the silk and Capron, the hydrogen bonds of the groups -CO-NH- being preserved. As a result of irradiation of silk in air breakdown of the main fibroin chain and loss in packing density of the macromolecules take place.

Sandwich structures. Space Aeronautics *35,* 46-57 (Mar. 1961). Three articles discuss the use of sandwich structures in the B-70; the properties of these composites, their production, and self-sealing characteristics on puncture are described.

Diphenyl ether derivatives in condensation polymers. J. D. Doedens and H. P. Cordts. Ind. Eng. Chem. *53,* 59-62 (Jan. 1961). The thermal and oxidation stability of plastics containing the stable diphenyl ether nucleus was studied. Compounds based on chloromethyl derivatives of diphenyl ether containing 17 to 32% chlorine can be polymerized to thermosetting resins. As low-density foams, they are tough, chemically resistant, nonflammable, and can be produced with a range of properties. If the polymerization is carried out under pressure in the presence of inorganic fillers, the polymer acts as a tough, thermosetting, fire-resistant binder for the filler. The foams or bonded fillers should find utility as fire-resistant building materials suitable for all phases of the construction industry.

Molding and fabricating

Large plastics moldings ok'd by ultrasonic testing. J. M. Kramer, A. F. Nuzzo, and G. Epstein. Materials in Design Eng. *53,* 13-16 (Feb. 1961). Ultrasonic testing can be used to detect location, size, and orientation of voids, cracks, and resin-rich or resin-starved areas of massive compression-molded plastic parts. It is a rapid, reliable, and economical way to check critical moldings.

New results concerning the strength of welded seams in rigid PVC sheet. H. Jungnickel. Kunststoffe *51,* 105-07 (Feb. 1961). The results of experiments on welded seams in polyvinyl chloride (PVC) based on emulsion polymer, suspension polymer, and impact resistant PVC, joined with welding rod made of the same materials, are reported.

Applications

Organosilicon esters of acrylic and methacrylic acid. B. N. Dolgov, E. V. Kukharskaia, and D. N. Andreev. Vysokomolekuliarnye Soedineniia *2,* 1463-65 (Oct. 1960). Organosilicon esters of acrylic and methacrylic acid are capable of polymerization under the action of peroxide catalysts and ultra-violet light with the formation of rubber-like or solid transparent colorless polymers. The polymers with a three-dimensional structure have high softening temperatures. All the polymers are easily hydrolyzed by water. The polymer obtained from triacyloxysilanes is water soluble.

Properties of polyester-resin/glass-fiber banding rings. M. M. Felger. Electro-Technology *66,* 186-87 (Oct. 1960). Windings of rotating electrical equipment have always been restrained from centrifugal movement by a steel-wire banding system. Recently polyester-resin/glass-fiber bands have been used on selected equipment. Data that could be used in designing such banding system for a wide range of equipment are given.

Reinforced "Teflon" used in satellite. Insulation *7,* 78 (Jan. 1961). Teflon reinforced with ceramic fibers was used in the second stage of Discoverer XII as beacon antennae. The material was selected because of its electrical properties and its ability to ablate uniformly under the tremendous speeds, pressures, and temperature changes encountered during orbitting and when leaving and entering the earth's atmosphere.

Migration of lead from lead-stabilized PVC pipes. H. Niklas and W. Meyer. Kunststoffe *51,* 2-6 (Jan. 1961). Experiments were made to determine the manner in which lead compounds are leached out of PVC pipes containing various amounts of lead stabilizer. These investigations show that PVC pipes can be used safely for conveying drinking water as long as they are adequately rinsed inside before use and their lead content is below 1 percent.

Making polycarbonates: A first look. Chem. Eng *67,* 174-77 (Nov. 14, 1960). A plant, including a process flowsheet, for the production of polycarbonate resin is described. Polycarbonates are the first thermoplastic resins in which the linking elements are carbonate units and can be fabricated by almost all techniques used with plastics. They have high impact strength, good heat resistance, exceptional dimensional stability, and good electrical properties. The plant described reacts bisphenol-A with phosgene in the presence of pyridine and an undisclosed solvent. The pyridine permits removal of hydrochloric acid as pyridine hydrochloride.

Epoxy-glue pipe joint avoids expensive weld. Chem. Eng. *67,* 160, 162 (Nov. 28, 1960). The joining of thin-wall steel pipe by epoxy adhesive is described. Installation costs using this technique are reduced about 25% and installation time about 50%, compared with welded joints. It is also applicable to thin-walled **(To page 66)**

* Reg. U.S. Pat. Off.

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Pentachlorophenol • Sodium Pentachlorophenate • Sulfuric Acid • Methanol

lined pipe. Maximum working pressure is 1200 p.s.i. for 3-in. and smaller joined pipe and 800 p.s.i. for larger pipe. In addition to application for the adhesive, the completion of the joint involves a hydraulically actuated crimping tool and a stable position for the time interval 15 min. to 48 hr. after crimping to prevent fractures in the adhesive. Applications have been in salt water, crude oil, gas lines.

Urethane coatings aim high for new jobs. Chem. Week *87*, 27-28, 30, 32 (Nov. 5, 1960). The major types of urethane plastic coatings are discussed and compared.

Properties

Dynamic mechanical spectrometry by means of rolling friction measurements. D. G. Flom. Analytical Chem. *32*, 1550-54 (Nov. 1960). Successful correlation of rolling frictional properties of polymers with dynamic mechanical losses has led to a useful technique for studying bulk physical properties. Dynamic mechanical spectra are obtained by plotting the coefficient of friction versus temperature. These spectra have been obtained on a variety of polymers ranging from soft elastomers to hard thermoplastics. The spectra may be used to determine branching, crystallinity, plasticizer content, as well as to indicate the presence of individual components in blends of polymers.

Ultrasonic attenuation of longitudinal waves in plastics. M. Auberger and J. S. Rinehart. J. Appl. Phys. *32*, 219 (Feb. 1961). Hughes' pulse technique for measuring longitudinal velocities is adapted and extended to measure attenuation of longitudinal waves in the frequency range from 250 to 1000 kc. Data for attenuation in six different plastics are given for eight different frequencies. Attenuation in nepers per wave-length decreases when frequency increases for all plastics, except Teflon, which shows a well-defined peak at approximately 700 kc.

Thermochemical assessment of the structural properties of polymeric materials. B. E. Geller. Vysokomolekuliarnye Soedineniia *2*, 1466-69 (Oct. 1960). A method for assessing the structural properties of polymeric materials is based on the rate of evolution of heat during swelling of the high molecular compounds. The intensity of the heat flux arising on diffusion of the solvent into the material may serve as characteristic of the structural density. This new characteristic of the density of the molecular structure is called "the coefficient of heat evolution." The molecular structure density characteristics of carbochain fibers is presented.

Change in properties of some polymers attached to a glass surface. Iu. S. Lipatov and G. M. Pavluchenko. Vysokomolekuliarnye Soedineniia *2*, 1564-68 (Oct. 1960). A study was made of the swelling of thin gelatin and polystyrene films and of the same films applied to a glass fiber surface. The degree of swelling of gelatin on the surface is lowered in comparison with the free gelatin, whereas in the case of polystyrene it is augmented. A fall in the glassy transition temperature of polystyrene from 80.4° for the free polymer to 74.6° for that on the glass surface occurs. There is a significant change in properties of polymers in the form of thin films on the surface. This is due to interaction of the glass surface with the packets of molecular chains.

Orientation of amorphous and crystalline regions in nylon 66 filaments. F. P. Chappel. Polymer *1*, 409-17 (Dec. 1960). The change in molecular orientation produced by slow extension was followed in filaments of nylon 66 by dichroism and birefringence measurements. The dichroism, obtained by dyeing the filaments with dichroic dyes before extension, was taken as a measure of the orientation of the amorphous regions, and the birefringence as a measure of the orientation of both the amorphous and the crystalline regions. The orientations of these regions were then deduced as a function of extension. The orientation of the crystalline regions is superior to that of the amorphous regions at all stages of extension, but most markedly in the earlier stage.

Chemistry

Ester decomposition reactions in vinyl and acrylic polymers. N. Grassie. Plastics Inst. Trans. 28, 233-37 (Dec. 1960). The degradation of vinyl and acrylic resins in plastic compositions appears to be different from that observed in model compounds and thus these principles are not completely applicable to commercial products.

Molecular size distribution and gelation of irradiated copolymers. M. Inokuti. J. Chem. Phys. *33*, 1607-15 (Dec. 1960). Polymers become cross-linked and/or degraded when subjected to high-energy radiations. The molecular size distribution is altered and a large molecular network is formed at a certain dose that reflects the predominance of crosslinking over degradation. A theory is developed of the molecular size distribution and gelation of irradiated copolymers composed of two different kinds of monomer units. The gel point is given as a function of concentrations of the monomer units in the system. The problem of gelation of a mixture due to irradiation when crosslinking competes with main-chain scission is also treated.

Testing

An optical method for measuring uniformity in plastics. R. M. Eichhorn. Ind. Eng. Chem. *53*, 67-70 (Jan. 1961). A method for making reproducible measurements for uniformity of mixtures is required in mixing operations. For transparent and translucent materials, the standard deviation of optical absorbance provides a numerical index for the degree of mixing accomplished. The variation in absorbance is obtained by scanning a thin sample with a microdensitometer. When the transmitted light, sensed by a phototube, is fed to an analog computer as a varying voltage signal, the standard deviation value is reproducible and reliable. Automatic computation of the standard deviation reduces analysis time and makes the method simple enough for routine use.

Ebulliometric apparatus for studying number-average molecular weights of polymers. C. A. Glover and R. R. Stanley. Anal. Chem. *33*, 447-50 (Mar. 1961). An ebulliometric apparatus for rapid, accurate measurements of boiling point elevation of dilute polymer solutions is described. An improved thermopile makes possible a greater sensitivity in temperature measurement. The resulting apparatus is equal in sensitivity to those previously reported; added advantage is its simplicity in design and operation.

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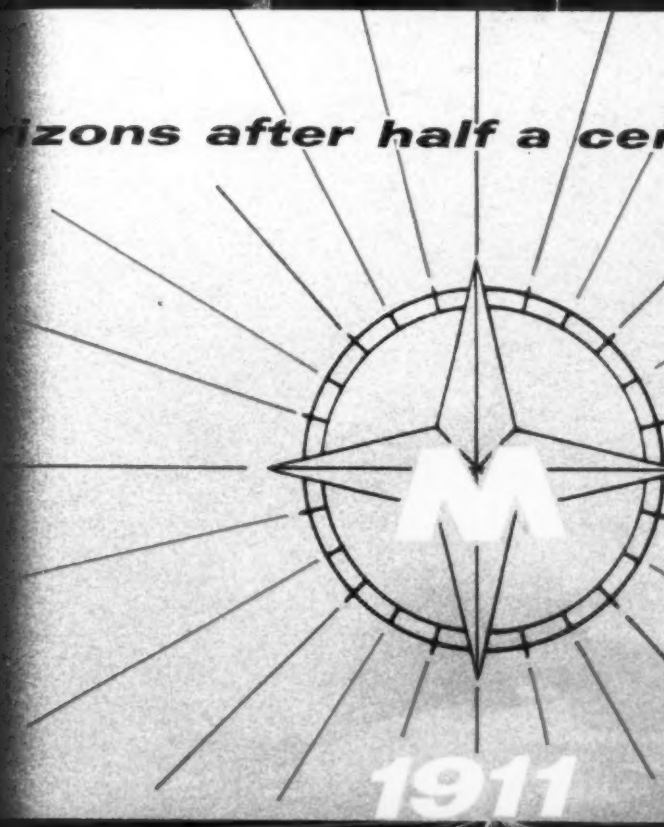

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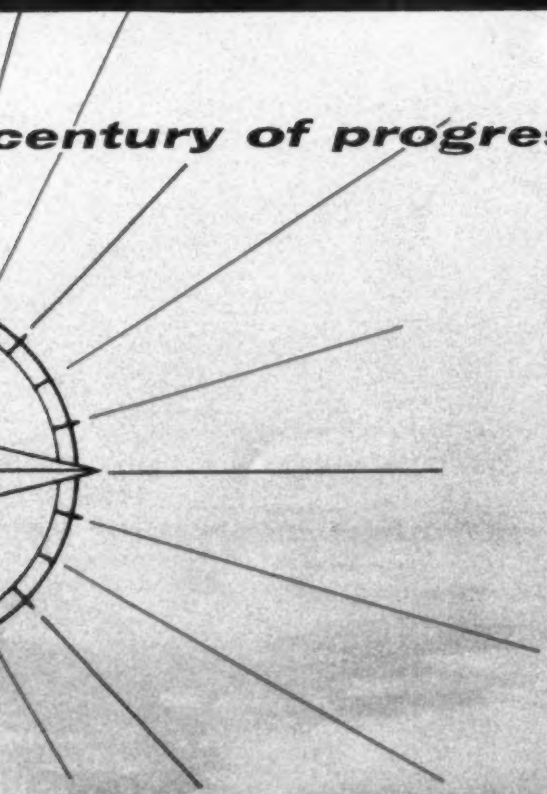

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Flexible hose. M. M. Kahn (to Acme-Hamilton). 2,968,321.

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Illuminants. J. A. M. Brock (to Olin Mathieson). 2,968,542.

Polyurethane latex. J. E. Mallonee (to Du Pont). 2,968,575.

Coating polyethylene with a vinylidene coating. T. W. Keller, C. W. Garvin, and J. B. McMillan (to Howard Plastics). 2,968,576.

Insolubilizing hydroxylated polymers. B. H. Kress (to Quaker Chemical). 2,968,581.

Curable ethylene polymers. G. H. Bowers III (to Du Pont). 2,968,637.

Polyester-chlorinated diphenyl compositions. J. R. Caldwell and R. Gilkey (to Eastman Kodak). 2,968,639.

Stabilized polypropylene. J. Roberts and J. K. Rose (to Union Carbide). 2,968,641.

Stabilized composition. N. M. LeSuer (to Lubrizol). 2,968,642.

Phenolic resins. L. S. R. Norrhede (to Dyfoam). 2,968,644.

Polyformals of cyclic diols. J. R. Caldwell and W. J. Jackson Jr. (to Eastman Kodak). 2,968,646.

Elastomeric terpolymers. J. R. Pailthorp and H. E. Schroeder (to Du Pont). 2,968,649.

Vinylidene-chloride polymers. L. C. Friedrich Jr., J. W. Peters, and M. R. Rector (to Dow). 2,968,651.

Polypropylene. T. S. Mertes (to Sun Oil). 2,968,652.

Polyisocyanates. S. N. Ephraim (to Reichhold). 2,968,672.

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Epoxy resin. R. Steckler (to Food Machinery). 2,969,334.

Polyester-amine products. J. K. Simons (to Quaker Chemical). 2,969,-335.

Epoxidized polyesters. B. Phillips and P. S. Starcher (to Union Carbide). 2,969,336.

Polyester. M. Dohr and H. J. Krause (to Dehydag). 2,969,339.

Polyethylene-wax composition. J. J. Kaufman and P. R. Temple (to Gulf). 2,969,340.

Vinyl resin-acyl borate composition. D. J. Buckley and S. B. Robison (to Esso). 2,969,341.

Polypropylene. E. W. Dobson and T. J. Kelly (to Sun Oil). 2,969,344.

Polyisocyanates. W. R. McElroy (to Mobay). 2,969,386.

Epoxides. F. N. Hill, J. T. Fitzpatrick, and F. E. Bailey Jr. (to Union Carbide). 2,969,402.

U.S. Pats., Jan. 31, 1961

Injection molding. J. W. Hendry (to Tube-Turns). 2,969,563.

Reinforced plastic springs. D. E. Nelson (to Minnesota Mining). 2,969,-971.

Urethane-modified drying oil. H. M. Hauge and J. A. Pawlak (to Spencer Kellogg). 2,970,062.

Polymeric structures. D. E. Brasure (to Du Pont). 2,970,066.

Coated metal. S. C. Lashua and W. K. Schweitzer Jr. (to Dow). 2,970,070.

Joining metallic surfaces. J. H. Groves (to American Can). 2,970,077.

Polyethylene bond. A. R. Nielsen (to Plax). 2,970,078.

Surface-coated waterleaf. J. A. Klacsmann (to Du Pont). 2,970,079.

Polymeric compositions. W. W. Hunt, S. G. Ludington, and J. L. Amos (to Dow). 2,970,089.

Polyurethane foam. C. L. Wilson and H. G. Hammon (to Hudson Foam Plastics). 2,970,118.

Polyester-urethanes. J. R. Caldwell (to Eastman Kodak). 2,970,119.

Foamed carbamide resins. W. H. Kreidl and O. Vieli (to Kreidl, Ritter). 2,970,120.

Molding compositions. R. A. Schmittberger (to Union Carbide). 2,970,-121.

Graft-copolymers. F. M. Rugg and J. E. Potts (to Union Carbide). 2,970,129.

Glycidal polyethers. A. B. Finestone (to Westinghouse). 2,970,130.

Polycarbonate process. W. W. Mayer Jr., J. Wynstra, and J. S. Fry (to Union Carbide). 2,970,131.

Nitrogen base polymers. W. B. Reynolds and J. E. Pritchard (to Phillips). 2,970,132.

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Wound plastic structure. W. T. Johnson and F. R. Barnet (to U. S.). 2,970,343.

Cellulose ester diisocyanate composition. J. H. Prichard (to Celanese). 2,970,970.

Polyacrylonitrile. O. Sunden and E. M. Sorvik (to Superfosfat Fabriks). 2,970,977.

Plasticized resin. P. O. Powers (to Pennsylvania Industrial Chemical). 2,970,978.

Vinyl chloride resin. G. P. Mack (to Metal and Thermit). 2,970,980-1.

Polysiloxanes. B. A. Bluestein (to General Electric). 2,970,982.

Epoxy-containing condensates. H. A. Newey (to Shell). 2,970,983.

Epoxyalkyl ethers. G. F. D'Alelio (to Koppers). 2,970,984.

Acrolein-pentaerythritol resin. H. R. Guest, J. T. Adams, and B. W. Kiff (to Union Carbide). 2,970,985.

Linear polyesters. D. W. Woodward (to Du Pont). 2,970,986.

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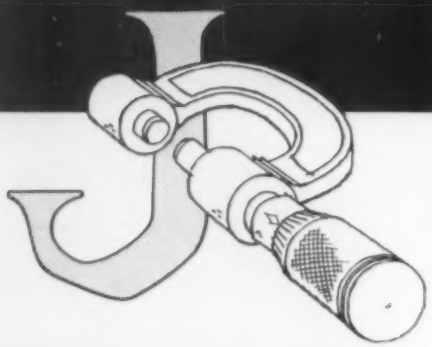

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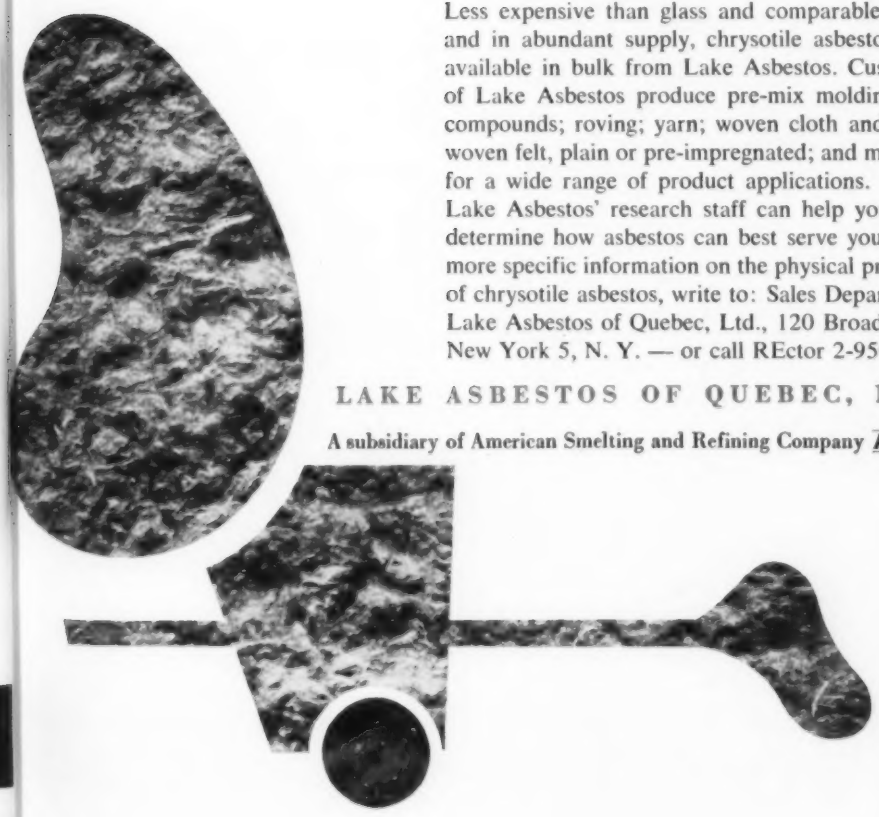

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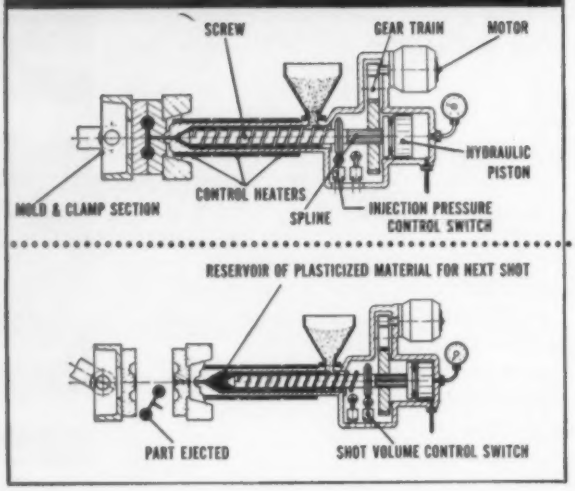

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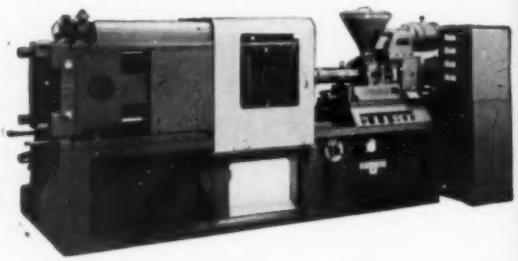

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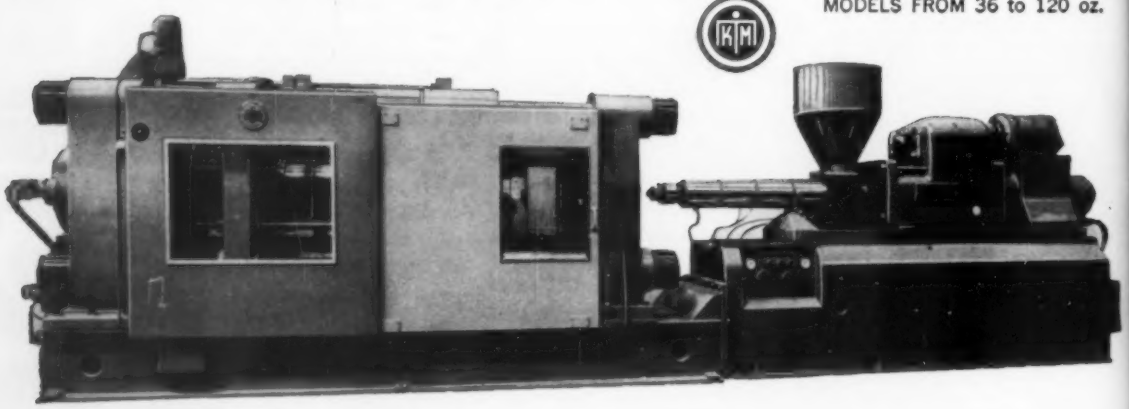

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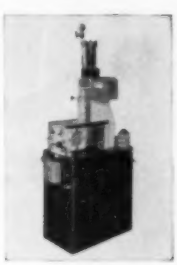

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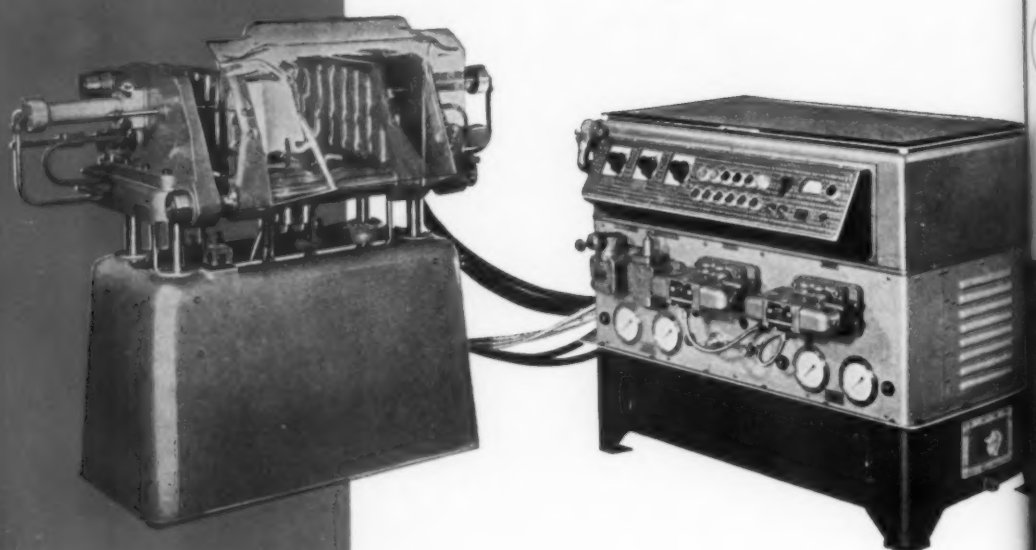

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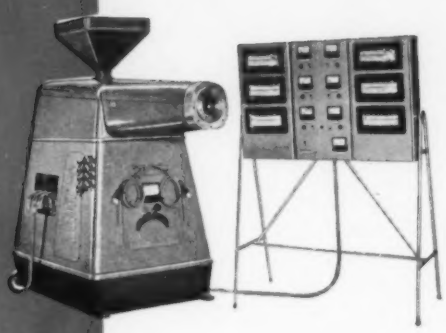


45 mm - 60 mm

L/D ratio 1:20

BOM

DRY COLOUR MIXER

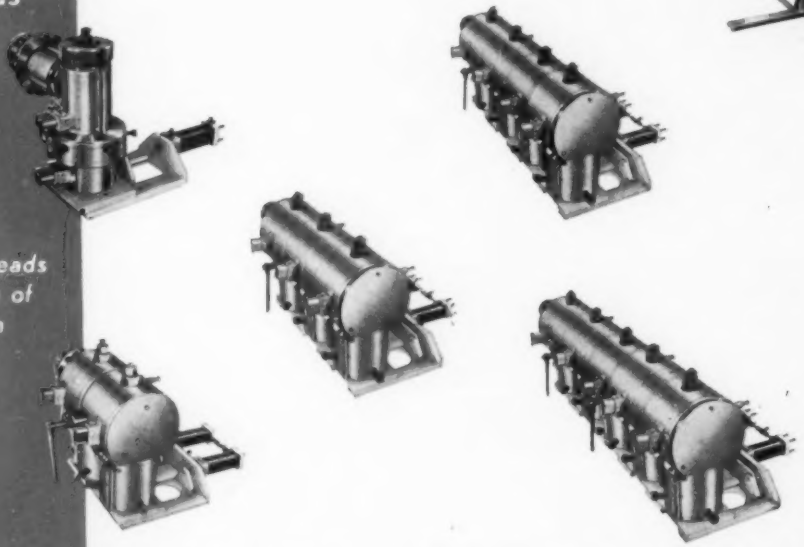
Excellent mixing

Capacity: 200 Litres

1-2-3-4-5 zone heads

Adjustable wallthickness

Valves in multiheads allow production of different items in the same cycle



EXTRUDER CROSS HEADS

BLOW O MATIC CORP. LTD.

Among the important factors in Shell Chemical's decision to make polystyrene were its extensive background in polymers and its raw material position. Two other Shell thermoplastics followed quickly—polypropylene and polyethylene.

BULLETIN:

On May 3, 1960, a remarkable thermoplastics decision was made by Shell Chemical

Read about this Shell decision. And how you can start benefiting today from a major new source of polystyrene, polypropylene and polyethylene that resulted from it.

On MAY 3, 1960, Shell Chemical, a company long basic in styrene monomer and SBR rubber, decided to combine the two in full commercial production of Shell high impact polystyrene. Why was this remarkable?

A revealing fact on polystyrene

The condition of the polystyrene market was not attractive. There was oversupply from some of America's finest companies. The field was mature and Shell was starting late.

One revealing fact offset this situation. *Shell, with its excellent background in polymer chemistry—as exemplified by Shell Isoprene Rubber, the industry's first commercially produced synthetic/natural rubber—could make positive contributions to the thermoplastics field in the form of new products.* But Shell would be severely handicapped without a thorough understanding of how the thermoplastics market works and what it wants.

Result? Shell's decision to go full speed ahead with high quality general purpose, medium and high impact Shell polystyrenes, plus a rapidly expanding technical sales force.

80 million pounds of polypropylene

Two other thermoplastic developments followed quickly.

One, Shell's announcement in October, 1960, for an 80 million pounds a year polypropylene plant with customer service and research facilities to be built near Woodbury, N. J. Two, an arrangement by which Shell will resell limited quantities of polypropylene until this plant comes on stream.

Custom-made polyethylene

And this, in turn, led to a third important thermoplastic.

In order to round out a complete line of thermoplastics, Shell Chemical, in January, 1961, made arrangements to supply the industry with the highest quality custom-made polyethylenes.

How to start benefiting

Thus, within 8 months, Shell became an important factor in three plastics: Shell polystyrene, Shell polypropylene and Shell polyethylene.

The next 8 months should be even more important. Shell will be going full speed ahead searching for new polymers you want.

Now is the time to let Shell's technical representative know your needs. Tell him about them on his next visit or write Shell Chemical directly at:

42-76 Main St., Flushing 55, N.Y. FLushing 3-4200; 20575 Center Ridge Rd., Cleveland 16, O. EDison 3-1400; 6054 West Touhy Ave., Chicago 48, Ill. SPring 4-6711; or 10642 Downey Ave., Downey, Calif. SPruce 3-0601.

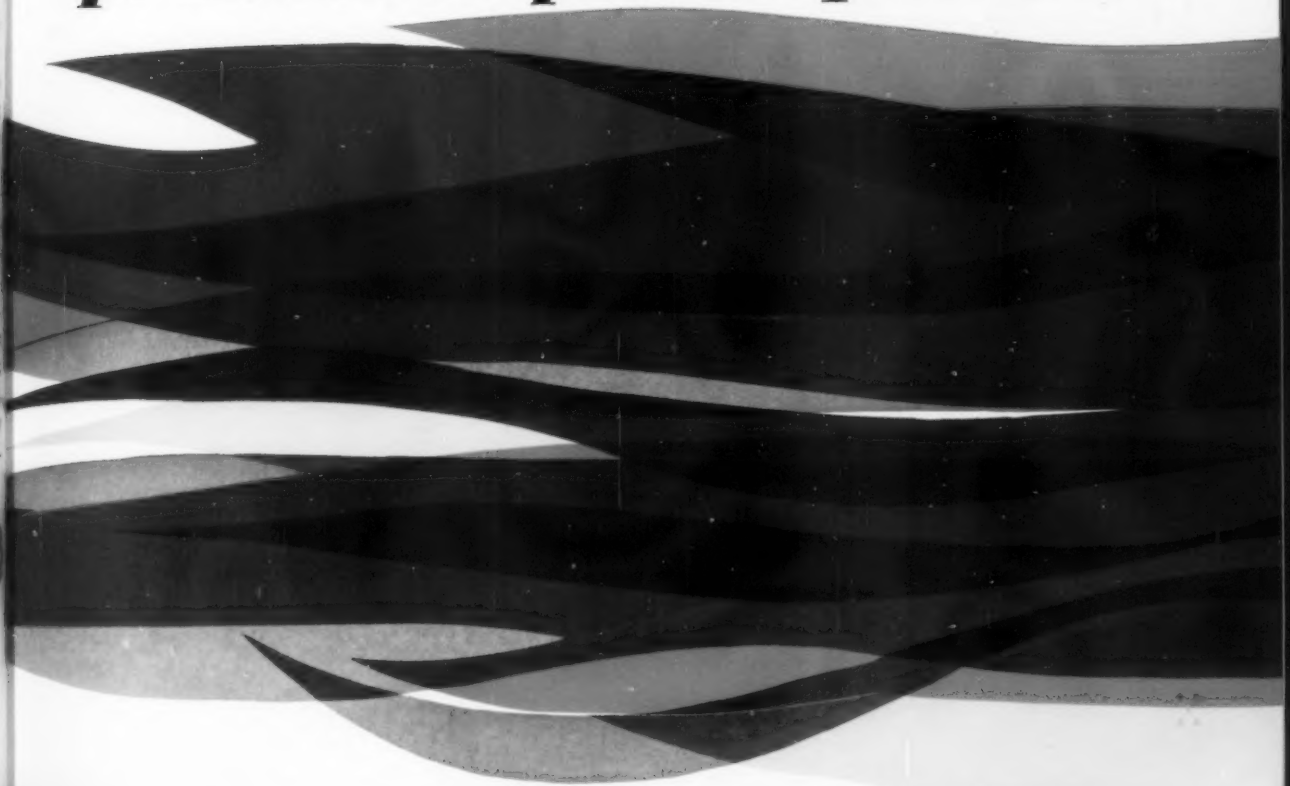
A Bulletin from

Shell Chemical Company

SHELL

Plastics and Resins Division

Foster Grant delivers... production proved plastics



The Foster Grant Family of

production proved plastics

FG®

Fostarene®

General-Purpose Polystyrene

Fosta Tuf-Flex

High-Impact Polystyrene

Fosta Nylon

During the past 42 years, Foster Grant has not only served the plastics industry's raw material needs but has also been the world's largest manufacturer of sunglasses. This valuable combination of resin experience and end-product know-how has given us a unique insight into the molder's operations, his production requirements and the products he manufactures and markets.

Our lifetime of successful plastics experience can actually be summed up in three words, "Production Proved Plastics" — resins we know will mold well because we've used them ourselves in an endless variety of applications. Foster Grant has always insured that not an ounce of resin will ever be marketed without the full knowledge that it can perform profitably and efficiently for our customers.

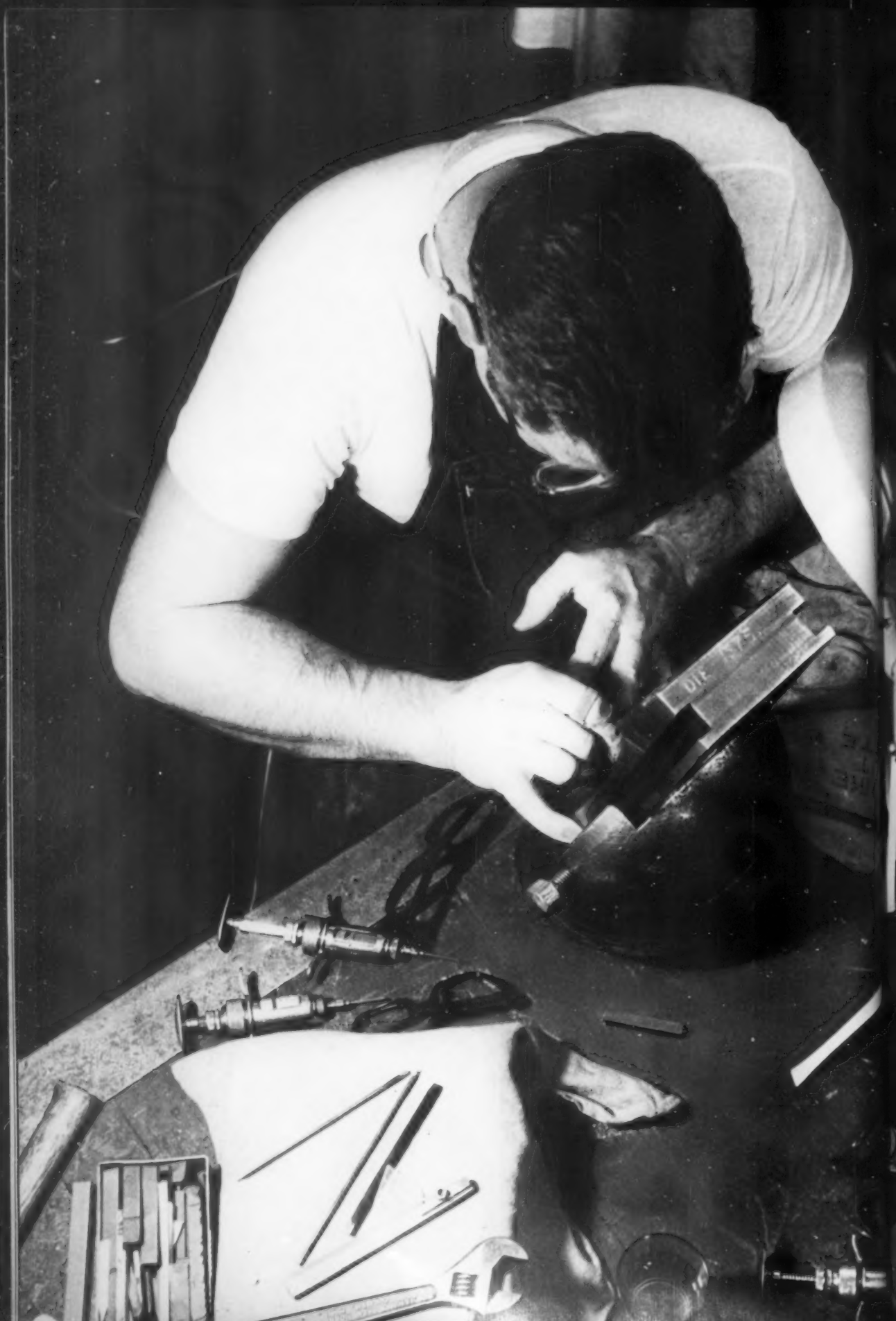
Standing behind this promise are many of the real pioneers in the plastics industry; men who helped Foster Grant achieve such plastics advances as the introduction of injection molding to America, the invention of the molding machine separator and the development of the first lubricated plastic.

Perhaps this know-how, these men and the full range of Foster Grant services can be of real value to your molding operation. Why not investigate today by calling us in Leominster. As always, we're ready to go to work with you right now!

Sincerely,

Joseph C. Foster

Joseph C. Foster
President,
Foster Grant Co., Inc.



Foster Grant's first-hand knowledge of every detail in the molding operation results in Production Proved Plastics.

END-PRODUCT EXPERIENCE

End-Product Experience, since 1919, is the key reason why Foster Grant, alone among major resin suppliers, offers Production Proved Plastics.

As proprietary molders we have long been aware of the molder's production and manufacturing problems. We use our own Fostarene Polystyrene, Fosta Tuf-Flex High-Impact Polystyrene and Fosta Nylon in combs, hair goods, package boxes, display stands and a great number of other fast-selling products that come from our molding room and sell through America's most important mass marketing media. The result is that Foster Grant has the unique opportunity to "production prove" raw materials on the production line before and during shipment to molders.

Raw materials supply, however, is only one area in which customers benefit from Foster Grant's end-product experience. Background in machine and mold design, tool and die service, precise color-matching and bulk handling combines with know-how in merchandising, marketing, packaging and point of sale promotion to bring molders a full range of technical assistance at any stage of product design, manufacture, distribution and marketing.

Foster Grant delivers... production proved plastics

FG®

Monomer from Foster Grant's Baton Rouge plant broadens markets for end-products.

RAW MATERIALS KNOW-HOW

Your new automobile tires, the synthetic soles of your shoes, the rubberized paint on the walls of your home, the insulation of your electric wires—these serviceable aids to modern living have one thing in common: many of them are made with styrene monomer manufactured by Foster Grant.

In 1954, Foster Grant's styrene monomer plant in Baton Rouge went on stream. This marked another step forward in the Company's concept of fully integrated raw material production. Monomer sales have increased four times in the last five years and, today, our single plant capacity is among the largest in the world.

At Foster Grant/Baton Rouge, styrene monomer production is highly automated and utilizes many processing innovations and features developed by the Company's own engineers. The plant is under almost continuous expansion, providing monomer for Polystyrene and Polyester resins, for synthetic rubber, paints and other emulsions.

New and improved raw materials are helping to shape the dynamic plastics future. The results will see broader markets for products with increased service life. An important part in this plastics progress will be played by versatile styrene monomer from Foster Grant.

Foster Grant delivers... production proved plastics

FG®

A Full Range...

Fostarene®
Polystyrene Resins

Fosta Tuf-Flex®
High-Impact Polystyrenes

Fosta® Nylon
Molding and Extruding Resins

		Description	Tensile Str	Elongat
	ASTM TEST		D638	D63
	UNITS		psi @ Fa	Percen Fail
GENERAL PURPOSE	FOSTARENE 20	General Purpose	6000-70	1.8-2
	FOSTARENE 50	Heat Resistant	7500-90	1.5-2
	FOSTARENE 122	High Flow	5500-65	1.3-1
CUSTOM GRADES	FOSTARENE 324	Molding Grade Medium Impact	4500-55	20-3
	FOSTARENE 326	Medium Impact High Flow	5000-60	21-2
	FOSTALITE 200	Molding Grade Light Stable	6000-70	1.8-2
	FOSTALITE 500	Extrusion Grade Light Stable	7500-90	1.5-2
	FOSTARENE 252	High Heat High-Impact	5500-60	15-2
	FOSTARENE 352	High Heat Medium Impact	7000-75	7-1
	FOSTA TUF-FLEX 216	Extrusion Grade High-Impact	4100-50	35-4
	FOSTA TUF-FLEX 226	Molding Grade High-Impact	3500-45	35-4
	FOSTA TUF-FLEX 289	Molding Grade High-Impact for Shoe Heels	3600-44	35
			psi @ Yie	
	FOSTA NYLON TYPE 61ASK	High Stiffness	12000	40
	FOSTA NYLON TYPE 62ASK	General Purpose	12000	40
	FOSTA NYLON TYPE 62BE	Extrusion Monofilaments	11000	40
	FOSTA NYLON TYPE BK40F	Extrusion	12000	10

*For unmodified Polystyrenes flexural strength is reported at failure. Above specifications for Fosta Nylon, with the exception of water absorption, determined on molded specimens containing less than 0.3% moisture.

Additional copies of this properties brochure, comprehensive technical literature, price lists and further information on all Foster Grant resins are available upon request.

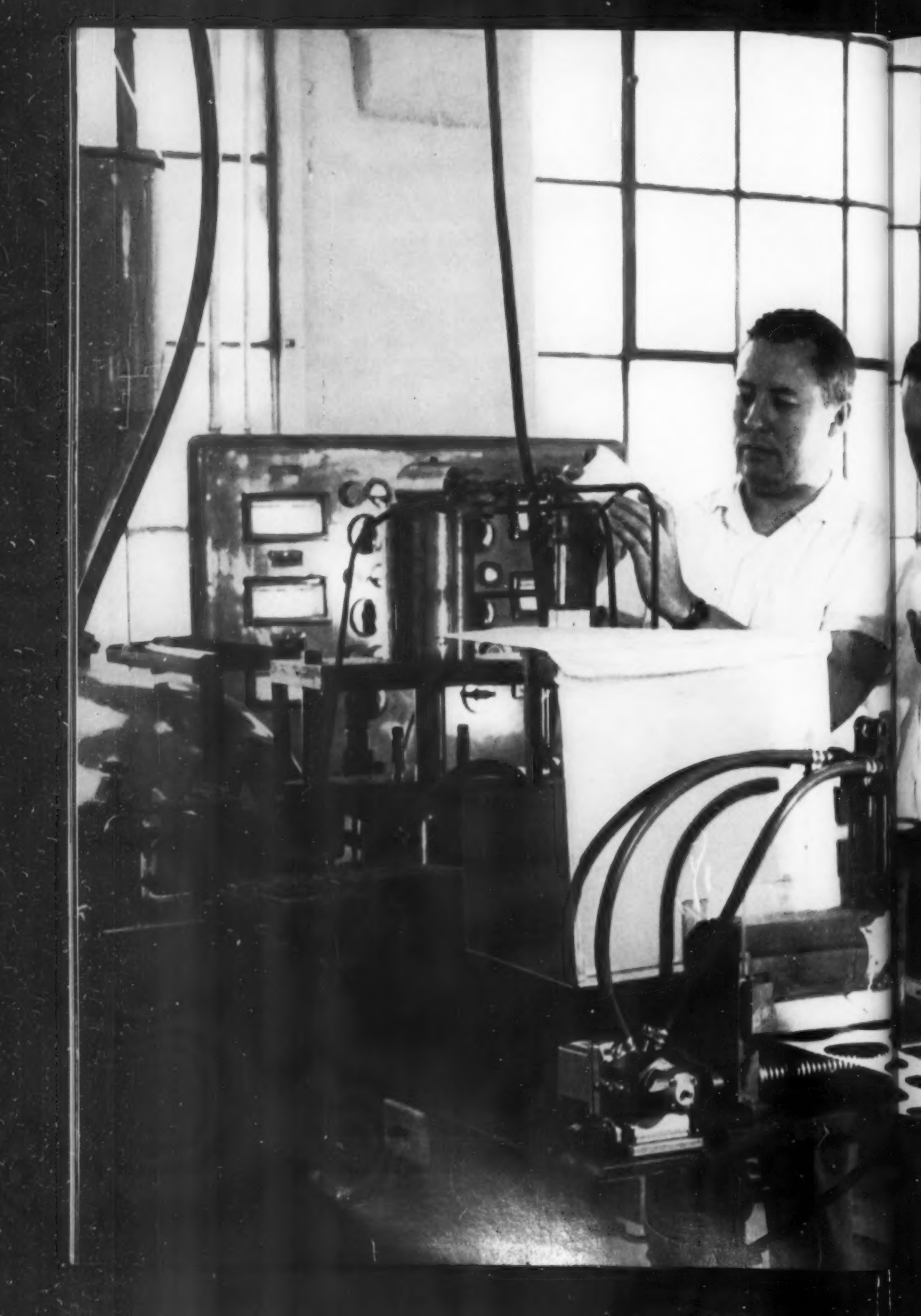
...of custom formulations in 3 basic thermoplastics

MECHANICAL PROPERTIES				THERMAL PROPERTIES			PHYSICAL PROPERTIES			
Elongation	Tensile Modulus	Flexural Strength	Izod Impact	Deflection Temp.		Flammability	Specific Gravity	Rockwell Hardness	Moisture Absorption	Mold Shrinkage
D638	D638	D790	D256	D648		D635	D792	D785	D570	D955
Percent @ Fail	psi x 10^5	psi @ Yield	ft-lbs./in notch	°F @ 66 psi	°F @ 264 psi	in/min.	—	—	Percent	in/in.
1.8-2.5	4.0-5.0	9000-10000*	0.35-0.45	—	170-180	0.5-2.0	1.04-1.07	M70-80	0.04	0.003-0.005
1.5-2.5	4.0-5.0	12000-13000*	0.35-0.45	—	195-200	0.5-2.0	1.04-1.07	M70-80	0.04	0.003-0.005
1.3-1.9	4.0-5.0	8500-9500*	0.25-0.35	—	160-170	0.5-2.0	1.04-1.07	M70-80	0.04	0.003-0.005
20-30	3.5-4.0	6600-7500	0.5-0.75	—	170-175	0.5-2.0	1.04-1.06	M40-55	0.05-0.10	0.003-0.005
21-27	3.9-4.0	7100-7500	0.60-0.70	—	150-155	0.5-2.0	1.04-1.06	M50-60	0.05-0.10	0.003-0.005
1.8-2.5	4.0-5.0	9000-10000*	0.35-0.45	—	170-180	0.5-2.0	1.04-1.07	M70-80	0.04	0.003-0.005
1.5-2.5	4.0-5.0	12000-13000*	0.35-0.45	—	195-200	0.5-2.0	1.04-1.07	M70-80	0.04	0.003-0.005
15-20	3.8-4.2	8500-9500	0.90-1.20	—	185-190	0.5-2.0	1.04-1.06	M45-50	0.05-0.10	0.003-0.005
7-15	3.9-4.5	9000-10800	0.50-0.75	—	190-195	0.5-2.0	1.04-1.06	M55-65	0.05-0.10	0.003-0.005
35-40	3.3-4.0	6100-6700	0.9-1.0	—	165-175	0.5-2.0	1.04-1.06	M35-45	0.05-0.10	0.003-0.005
35-40	3.0-3.7	5700-6200	0.9-1.2	—	160-170	0.5-2.0	1.04-1.06	M30-40	0.05-0.10	0.003-0.005
35	3.5	5900-6300	1.0	—	160-170	0.5-2.0	1.04-1.06	M30-40	0.05-0.10	0.003-0.005
40	4.0	16600	1.0	375	160	Self Extinguishing	1.14	R-115	1.6	0.010
40	4.0	16400	1.0	370	156	Self Extinguishing	1.14	R-112	1.6	0.010
40	3.8	16100	0.9	345	150	Self Extinguishing	1.14	R-117	2.0	0.010
100	4.0	16000	1.1	350	160	Self Extinguishing	1.13	R-117	2.0	0.007

FG®

FOSTER GRANT CO., INC.

Plastics Sales Division, Leominster, Mass., KEystone 4-6511



Veteran Foster Grant technical engineers help a customer reduce cycling time.

TECHNICAL SERVICE TEAMWORK

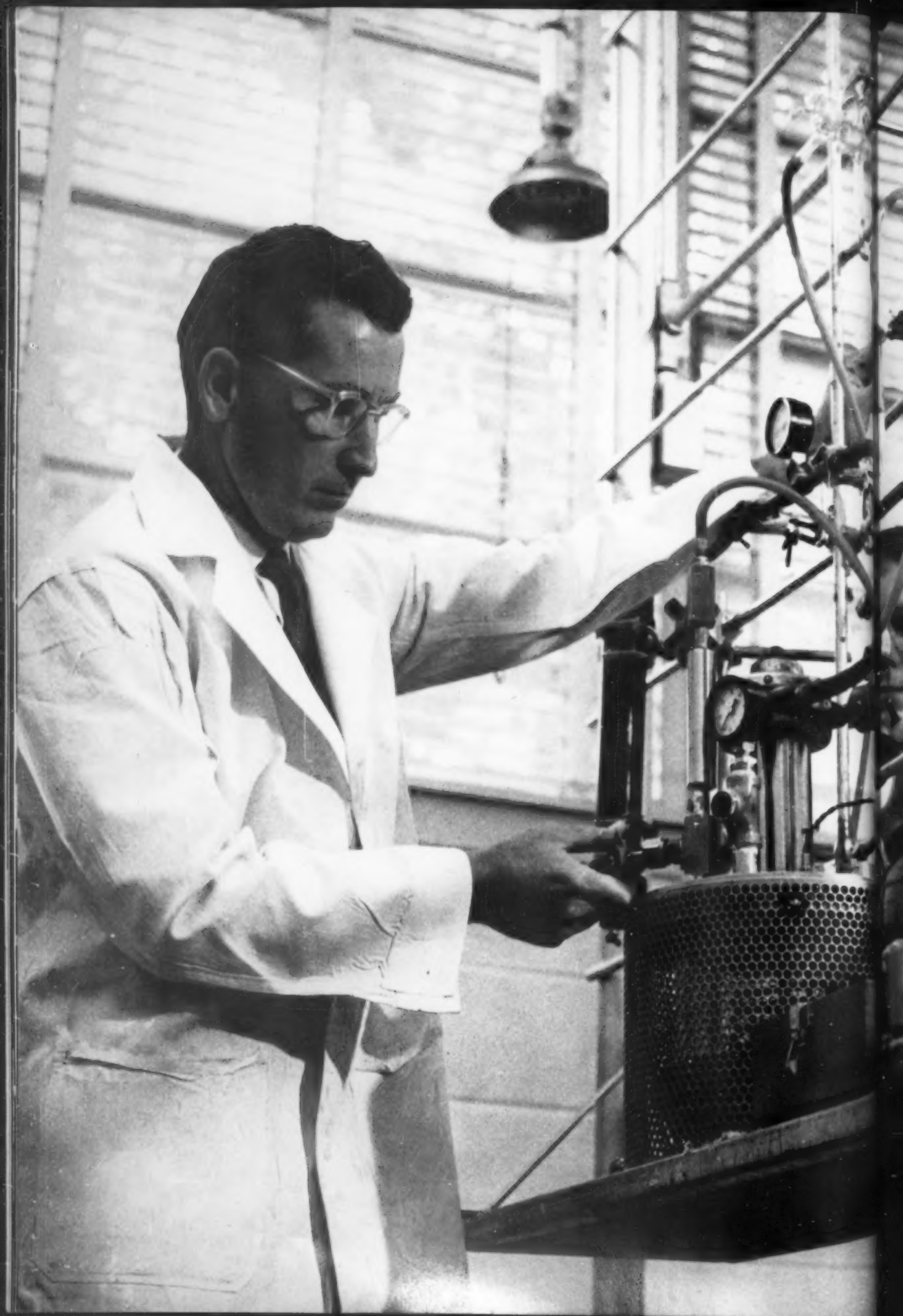
At Foster Grant, technical service is performed by men who have met and solved most molding problems years ago. These are the same veteran technical engineers who helped Foster Grant introduce injection molding to America back in 1931. Since then, many features of today's molding machines have come from innovations fashioned right here in Leominster.

It has taken a lifetime of successful plastics experience to acquire the unique molding know-how possessed by Foster Grant technical service engineers. Discoveries such as the molding machine separator, the first lubricated plastic and the advancement of hydraulic molding are only some of the milestones behind Foster Grant's plastics tradition. This extensive background is yours to call on when you mold with Fostarene Polystyrene, Fosta Tuf-Flex High-Impact Polystyrene and Fosta Nylon.

Our combination of raw material and end-product know-how results in a unique ability to help molders achieve new economies. Foster Grant customers can always depend on complete technical service in such areas as machine and mold design, tools and dies and precise color matching. A phone call to Foster Grant can put this valuable experience to work for you today.

Foster Grant delivers... production proved plastics

FG®



Experiments in Polymer Chemistry at Foster Grant mean more profitable, longer-wearing end-products.

ADVANCED RESEARCH AND DEVELOPMENT

Advanced Research and Development in such areas as stereospecific polymerization catalysts, polyamide polymers and co-polymers and graft polymerization are top priority projects at Foster Grant.

We know that only through persistent evaluation and re-evaluation can improved resins such as today's general-purpose polystyrene, high-impact polystyrene and nylon-6 result. These are the popular-priced plastics that help you produce more efficient, more profitable end-products.

Foster Grant's research and development facilities offer a challenging atmosphere for advanced study in basic and applied plastics research. The attractive New England community of Leominster, Massachusetts, offers a fine creative climate to stimulate dedicated and forward-thinking engineers and researchers who are helping Foster Grant shape the future of polymer chemistry.

When you mold with Foster Grant resins, the benefits of 42 years of successful plastics experience plus our expanded research and development capabilities are yours to draw on. Let us show you how we can apply this background to your molding operations.

Foster Grant delivers... production proved plastics

FG®

Customer Oriented Service from Foster Grant includes assistance in such areas as bulk handling and product design and marketing.

CUSTOMER ORIENTED SERVICE

Customer Oriented Service has been the Foster Grant way of doing business for the past 42 years—a concept based on customer assistance at any stage of the molding operation: Raw Material, Production and Marketing.

Bulk handling, for example, is a typical area in which Foster Grant extends Customer Oriented Service. As the world's largest manufacturer of sunglasses, Foster Grant knows first-hand the economies that result when resins are stored and used in bulk quantities. Savings on warehouse space, handling costs, production overhead, resin contamination and bag breakage are only a few of the profit-building extras that bulk handling makes possible.

Color matching is another example of how Foster Grant's extensive end-product experience can bring production benefits to molders. In addition, the well-known Color Requirement Plan is specially designed for customers using large and consistent quantities of Fostarene Polystyrene. These buyers forecast their Fostarene needs in advance and earn bonus savings through efficient buying performance.

In addition to bulk handling and precise color matching, Foster Grant's Customer Oriented Service includes help with machine and mold design, tools and dies, styling, displays and packaging.

Investigate today how Foster Grant's Customer Oriented Service can reduce overhead and bring production savings to your molding operation.

Foster Grant delivers... production proved plastics

FG®

Your Partner in Plastics Progress

FOSTER GRANT CO., INC.

Plastic Sales Division, Leominster, Mass., KEystone 4-6511

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Bulletin No. 61-16

Printed in U.S.A.

"PLASTICS PEOPLE" DON'T BLUSH...

when they're processed with Barber-Colman Controls

Even minor off-color "blushing" is eliminated when injection molders and extruders are Barber-Colman equipped. Barber-Colman Controls offer true color and accurate form through precise temperature control. And now, you can indicate temperature or pressure measurements on only one instrument with Barber-Colman's new 400 Series Capacitrols. Simply flip a selector switch to indicate the temperature or pressure. Also, you can record any combination of temperature and pressure up to 24 points with the new Series 8000 Recorders. Barber-Colman's wide ranging automatic process controls are the first choice in the Plastics Industry. Contact your nearest Barber-Colman, Wheelco Industrial Instruments Division office or write direct for complete information.

SERIES 8000 INDICATOR/RECORDER
Any combination of temperature or pressure recording up to 24 points. Separate 11" scales, up to six high or low limit switches, electronic potentiometer, swing out chassis.

SERIES 400 CAPACITROL INDICATOR
Pressure and Temp. selector switch, 6" scale, direct reading, high or low limits.

SERIES 400 CAPACITROL — more accurate 6" scale, no-contact Electronic Link, sensitive, reliable, plug-in chassis.

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Accurate, rugged dependable, no-contact Electronic Link, plug-in components.

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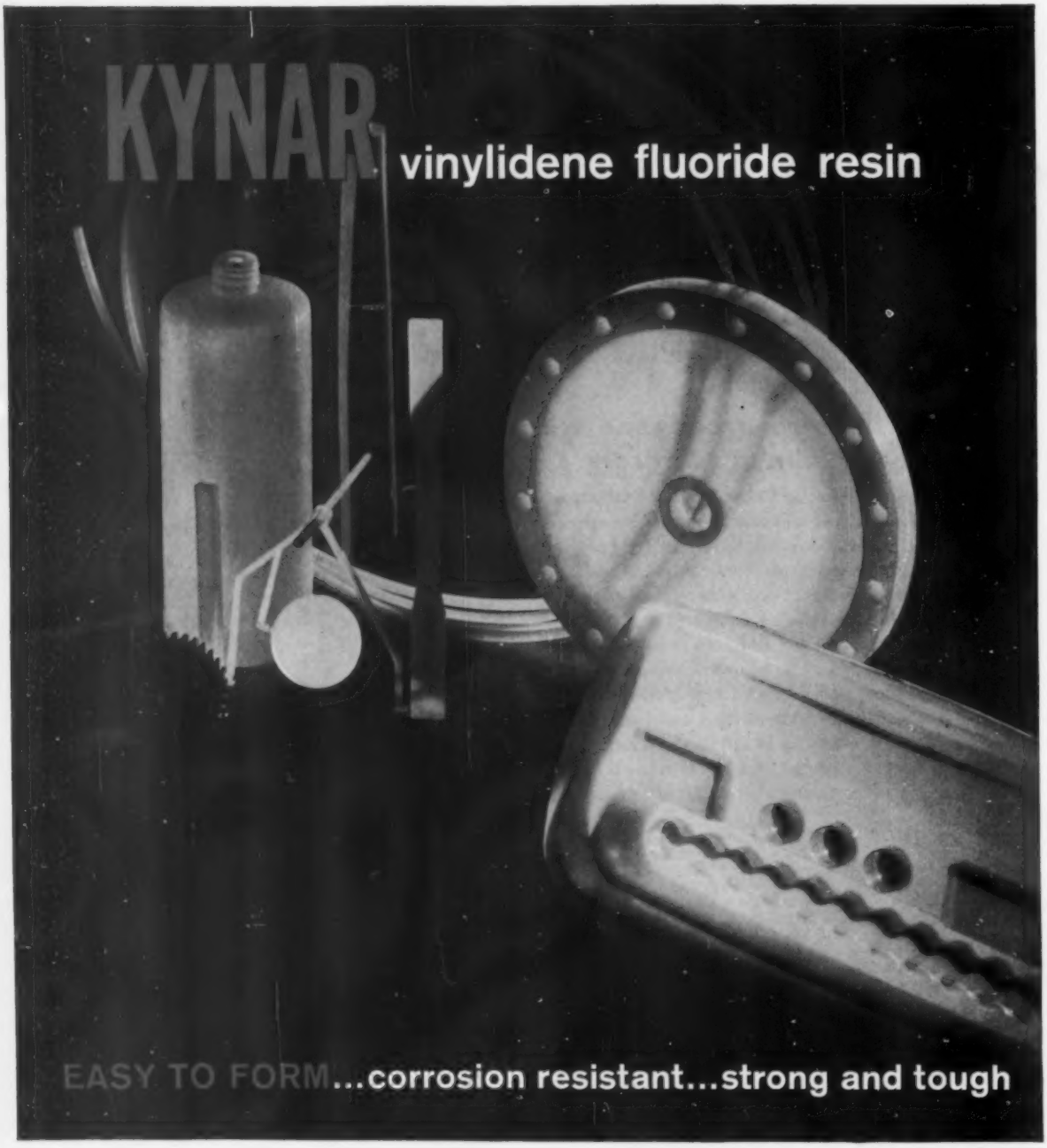

Ideal melt viscosity characteristics and high thermal stability make Kynar the most formable of fluorine-containing plastics. Kynar can readily be formed on standard equipment by all usual methods, including:

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Evaluate Kynar for applications in which you can profit from its unexcelled combination of properties —***resistance*** to chemical corrosion, wide-ranging temperatures and weather conditions . . . high ***strength***...and ***formability.*** Write for data, samples or technical aid. Research Products Development Dept., PENNSALT CHEMICALS CORPORATION, P. O. Box 4388, Phila. 18, Pa.

*Kynar is a trademark of Pennsalt Chemicals Corp.

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EXPANDABLE POLYSTYRENE

EXPANDEX OFFERS YOU COMPLETE SERVICE
BUY ONE PART . . . OR BUY ALL THREE

1

EXPANDEX OFFERS A TURN-KEY EQUIPMENT SYSTEM THAT IS LOW-PRICED, OPERATES ECONOMICALLY AND TAKES UP LESS FLOOR SPACE. Here are some of the exclusive features that make this possible: DRY HOT AIR PRE-EXPANDER shortens curing time; COMPACT TURBOBOILER produces a giant-sized head of steam at 80% efficiency; VERTICAL PRESS provides self-alignment of molds, fast mold changing; CONTROL CENTER integrates each operation into a fully-automatic system with independently variable time cycles.

2

EXPANDEX OFFERS PRODUCT DESIGN, PILOT RUNS, ENGINEERED INSTALLATION AND SERVICE . . . a complete unit service that includes everything you need from start to finish to be a custom molder or to produce items in your plant for your own use. Expandex experience, gained from the operation of its own custom molding service and the design and manufacture of its own equipment, assures success to purchasers of this complete service.

3

EXPANDEX OFFERS TO SELL FINISHED PRODUCTS OF EXPANDABLE POLYSTYRENE, CUSTOM DESIGNED AND MOLDED TO YOUR SPECIFICATIONS. This service includes full analysis of your package needs by the Expandex design staff, a group combining the talent and experience needed to assure maximum application of the advantages of this material; and high volume, high quality production from the latest Expandex automatic molding systems.

MANAGER OF MARKETING, DEPT. 1B,
EXPANDEX CORPORATION, Wauregan, Connecticut

- ☐ Send information on New Low-Cost Molding System.
- ☐ Tell me how to get started (my objectives enclosed).
- ☐ Send information on Custom Product Service.

Name_____ Title_____

Company_____ Address_____

SEND FOR FULL DETAILS

...consult **WESTCHESTER** *— compounders of polyolefin colors and special formulations*

VOLUME EXTRUSION of color formulations combines Westchester's continuing tradition of custom processing . . . with the many advantages of new production skills. Our formulating knowledge, based on craft and scientific precision, is the product of 14 years of service to the thermoplastics industry.

The staff and facilities of Westchester are available to your engineering department . . . for consultation on any problem involving polyolefin colors or special formulations.

The new FDA certified Westchester colors are now available. Approved for food, drug and cosmetic packaging — These colors are supplied with a registration number, attesting FDA approval of the pigments!

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ULTRAVIOLET LIGHT ABSORBERS

UVINUL is Antara's name for chemicals that protect against ultraviolet (UV) radiations; they function by absorbing these rays and dissipating this energy harmlessly. The UVINUL products are the most light-stable UV absorbers developed to date. They offer the widest range of application of any group of UV absorbers commercially available in the world.

Some examples of UV degradation are: loss of tack in adhesives, darkening of wood, fading, loss of dimensional stability, rancidity, and sunburn. The UV component in light (daylight or fluorescent) affects clear and pastel plastics too, causing discoloration, surface crazing, brittleness, and loss of tensile strength. If *your* product deteriorates in the presence of light, the cause may be UV radiations – and it's more than likely that the problem can be solved with a UVINUL absorber.

UVINUL products can be incorporated into UV-sensitive material directly – or can work in a protective shield, wrap, or coating. The table below suggests areas of use. Our chemists can help you apply the UVINUL absorbers effectively – and meanwhile, you can easily test their protective power by using clear cellulose acetate sheets containing UVINUL D-49. Just fill out the coupon and mail it to Antara for your free supply and directions for use.

SUGGESTED AREAS OF USE FOR UVINUL UV ABSORBERS

UV-SENSITIVE MATERIAL	UVINUL 400	490	D-49	D-50	DS-49	M-40	N-35
Acrylics	XX	XX	XX				
Epoxy Resins	XX		X				X
Cellulose Acetate	X		XX				
Latex					XX		XX
Nitrocellulose	X	X				X	XX
Paints, Oil-Base		XX	XX	XX		X	
Paints, Water-Base	X	X	X	XX	XX		
Polyester Resins	XX			X			X
Polyolefin Resins†							
Polystyrene	XX					XX	
Polyvinyl Chloride (PVC)	X		XX			X	
Rubber	XX					XX	
Urea-Formaldehyde Resins							XX
Urethanes		XX	X	XX			
Varnish	XX	XX	X	X		X	

LEGEND: X=compatible and effective. XX=compatible and effective to a superior degree.
†Samples of chemicals still under development are available for trial in these products.

*(AND USE)

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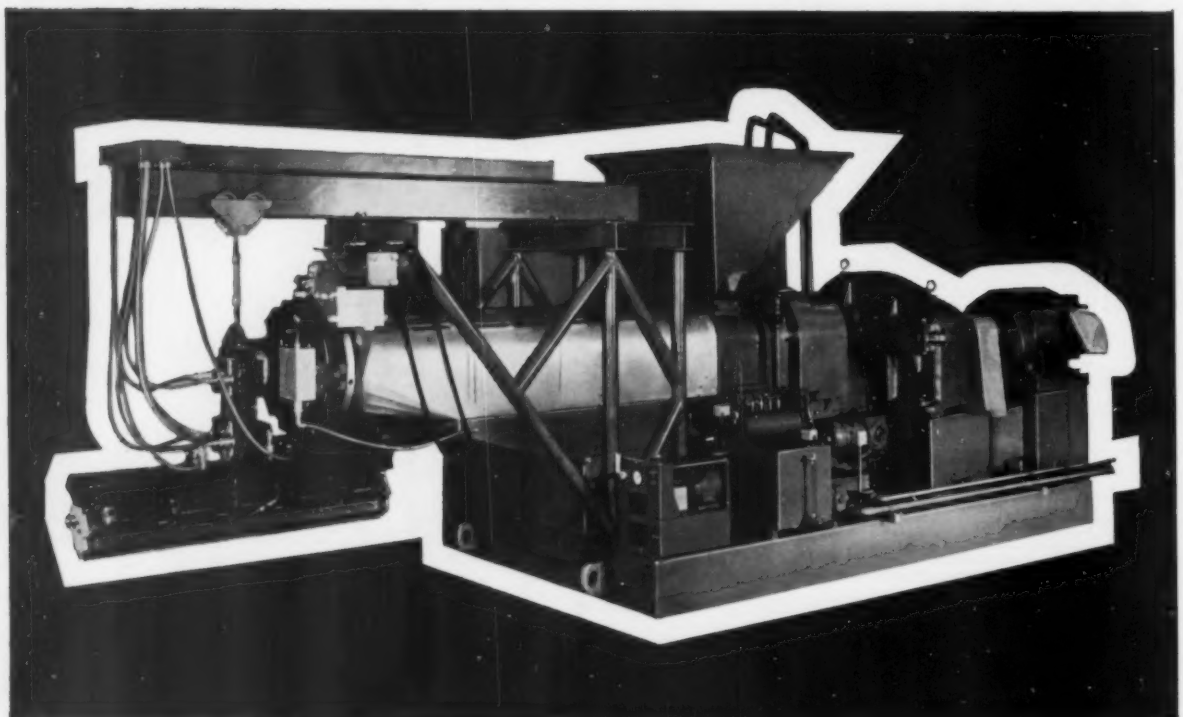
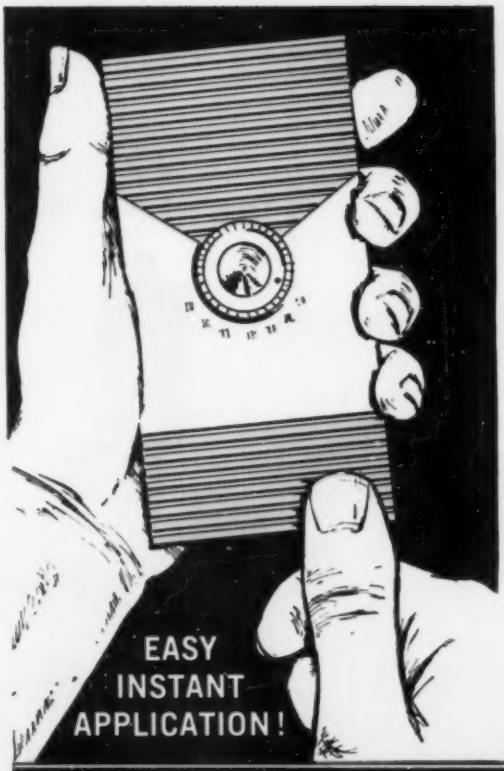


HALE and KULLGREN **PLASTICS DEPT.**
DILTS DIVISION
613 E. Tallmadge Ave., Akron, Ohio

BLACK-CLAWSON



26

EMBOSSED DESIGNS IN 6 METALLIC COLORS...

BACK PEELS OFF FOR ADHESION ▼

Choose from the largest variety of laminations, gauges and special effects in the field. Available in continuous rolls, cut-to-size sheets, die cuts or in widths as narrow as 1/4 inch.

Our design engineering department will assist you in selection and application to meet your individual needs. No cost or obligation.

ALL FABRICATION DONE BY US EVERY STEP OF THE WAY

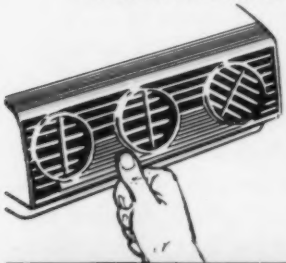
Every process in the fabrication of Mirro-Brite Mylar is done in our own factories... metalizing, coating, embossing, slitting and lamination. This insures uniform quality control plus significant savings to you.

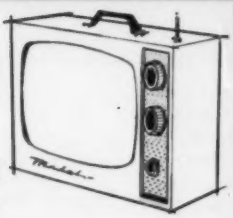
PRESSURE SENSITIVE **MIRRO-BRITE**

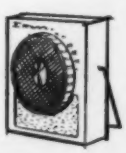
MADE WITH **"MYLAR"*** IN ROLLS SHEETS STRIPS DIE CUTS

*Ready Strip

ADHESIVE BACKED MYLAR PARTS







Decorative metalized trims pre-cut to your exact size and shape in continuous rolls. Peel off and press on! A big time saver on your production line.

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COATING PRODUCTS, INC.

101 WEST FOREST AVE. ENGLEWOOD, N.J.

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"PIONEERS IN METALIZED MATERIALS"

*A DuPont Polyester film

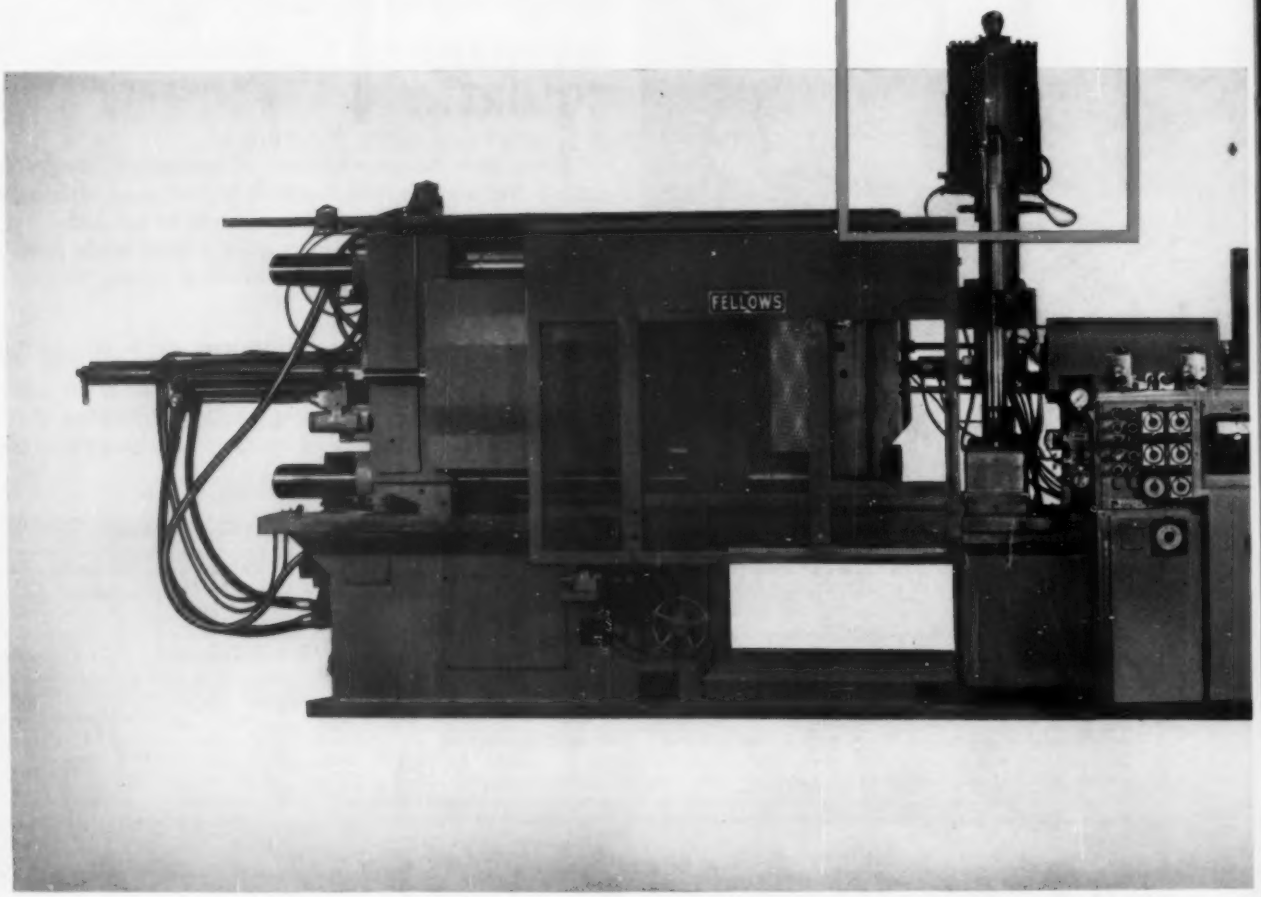
SEE US AT BOOTH NO. 504

NEW Model 12-450

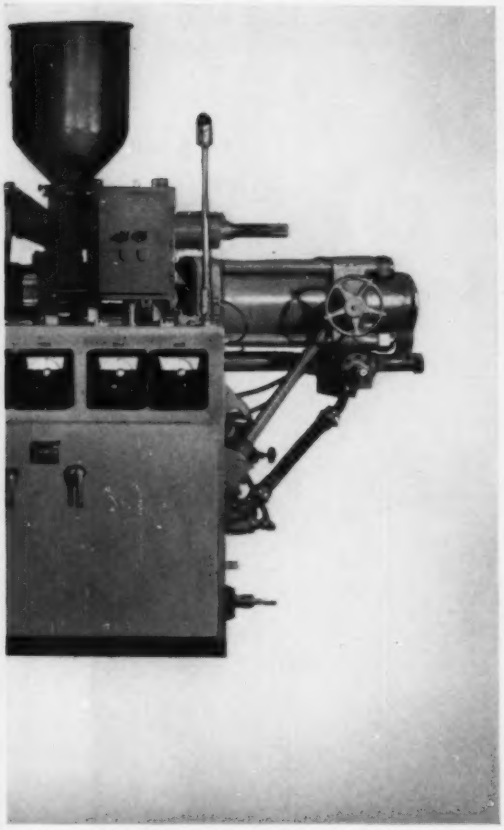
New Speed in an Intermediate-Size Molding Machine!

NEW

Transfer Injector Unit



Here are some logical steps to take in making sure of *your* share of the $5-billion plastics market forecast for '61. *Keep up* with new developments. *Tool up* with advanced equipment like the Fellows Injection Molding Machines described here. You'll get the benefits of such Fellows design features as the Transfer Injector Unit shown above on the new Model 12-450. It steps up productivity, improves quality and makes "tough" molding jobs easier. Fellows Injection Molding Machines provide low cost, high production of plastic parts — up to 50 ounces on a 12-450 with Transfer Injector Unit. Ask your nearest Fellows Representative for complete details.



NEW MODEL
12-450

Dry Cycles at 600-800 Per Hour
Makes Shots Up to 20 Ozs. with Prepack
Maximum Mold Size.....27" x 34"
Mold Locking Force.....450 tons
Mold Opens.....10"-20"
Horsepower.....40
Heater Unit.....21½ K.W.
Plasticizing Capacity.....150 lbs. per hr.

MODEL
12-350

Rated Capacity.....12-20 ozs.
Maximum Mold Size.....20" x 32"
Mold Locking Force.....350 tons
Mold Opens.....10"-20"
Dry Cycles Per Hour.....600-800
Horsepower.....40
Heater Unit.....21½ K.W.
Plasticizing Capacity.....150 lbs. per hr.

MODEL
6-10-225

Rated Capacity.....6-10 ozs.
Maximum Mold Size.....15" x 25"
Mold Locking Force.....225 tons
Mold Opens.....8"-14"
Dry Cycles Per Hour.....700-825
Horsepower.....30
Heater Unit.....14 K.W.
Plasticizing Capacity.....100 lbs. per hr.

MODEL
6-200

Rated Capacity.....6-9 ozs.
Maximum Mold Size.....15" x 21"
Mold Locking Force.....200 tons
Mold Opens.....6"-9"
Dry Cycles Per Hour.....490-650
Horsepower.....20
Heater Unit.....12 K.W.
Plasticizing Capacity.....75 lbs. per hr.

MODEL
3-125

Rated Capacity.....3-4.5 ozs.
Maximum Mold Size.....12" x 17"
Mold Locking Force.....125 tons
Mold Opens.....5"-8"
Dry Cycles Per Hour.....600-840
Horsepower.....15
Heater Unit.....6 K.W.
Plasticizing Capacity.....45 lbs. per hr.

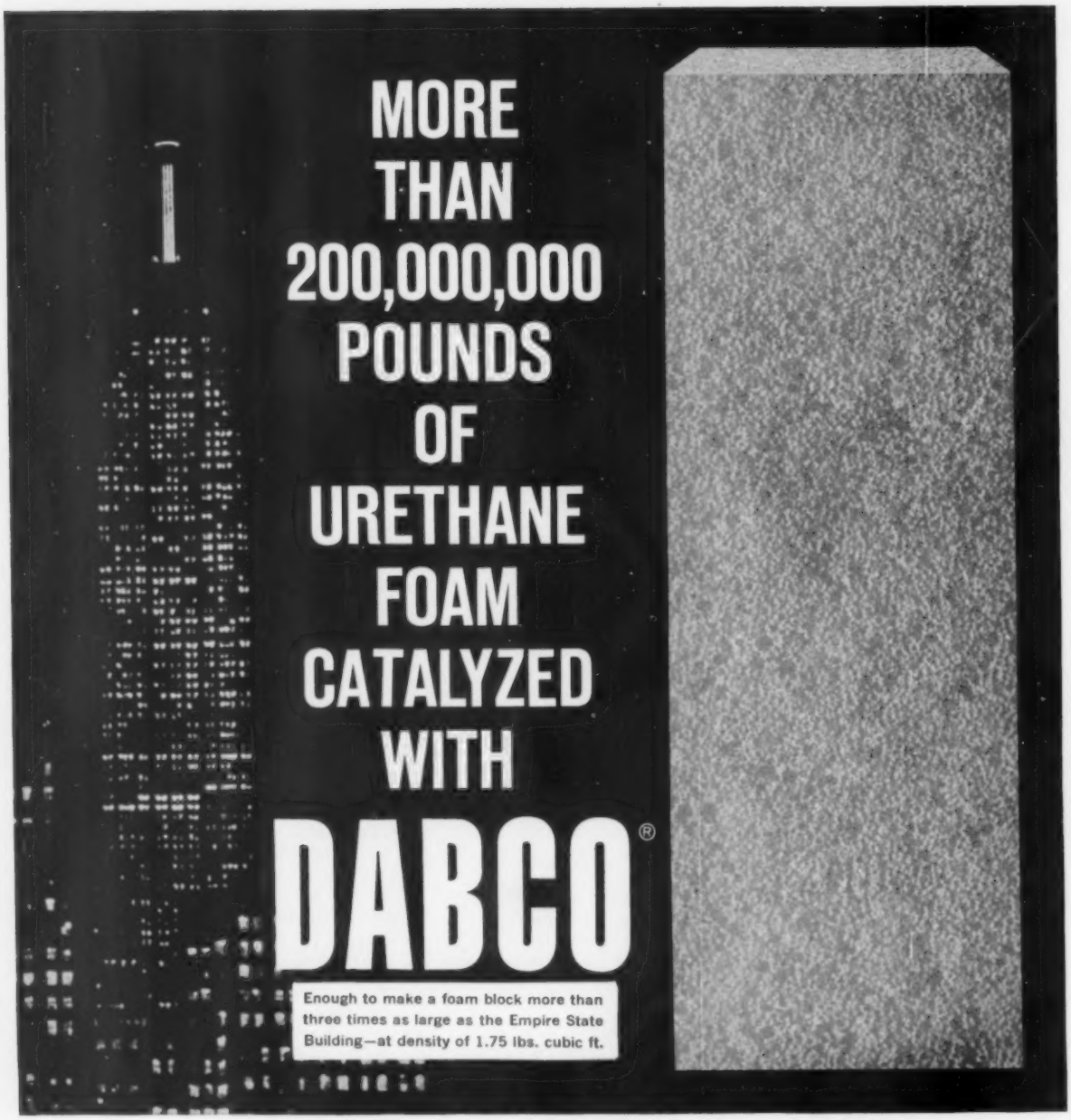
SOCIETY OF THE PLASTICS INDUSTRY · SPI

See the 3-125
with Rotary Spreader
Booths 619, 621 and 623
National Plastics Exposition

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY *Plastics Machine Division,* Head Office and Export Department, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich. • 150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39 • 6214 West Manchester Ave., Los Angeles 45


MORE THAN 200,000,000 POUNDS OF URETHANE FOAM CATALYZED WITH
DABCO®
Enough to make a foam block more than three times as large as the Empire State Building—at density of 1.75 lbs. cubic ft.

High purity—high activity—economical
Produces stable, odorless, fast-curing one-shot foams.

Fully proved. Now used by 127 foam manufacturers. Preferred for plant safety, very low toxicity.

Rigid Foams. Produces complete catalysis of highly functional polyols, resulting in good K factors, good dimensional stability and retention of chlorofluorohydrocarbon.

Flexible Foams. Minimum flex fatigue. Flexible foams catalyzed with DABCO are stable to heat and moisture.

Molding. DABCO produces uniform, first-grade skins; fast cures for short, economical mold cycles.

In elastomers and coatings, DABCO makes possible fast cures; improves overall physical properties. Write for latest technical bulletin and prices.

DABCO: Houdry Process Corporation trademark for triethylenediamine.
$C_6H_{12}N_2$

*HOUDRY
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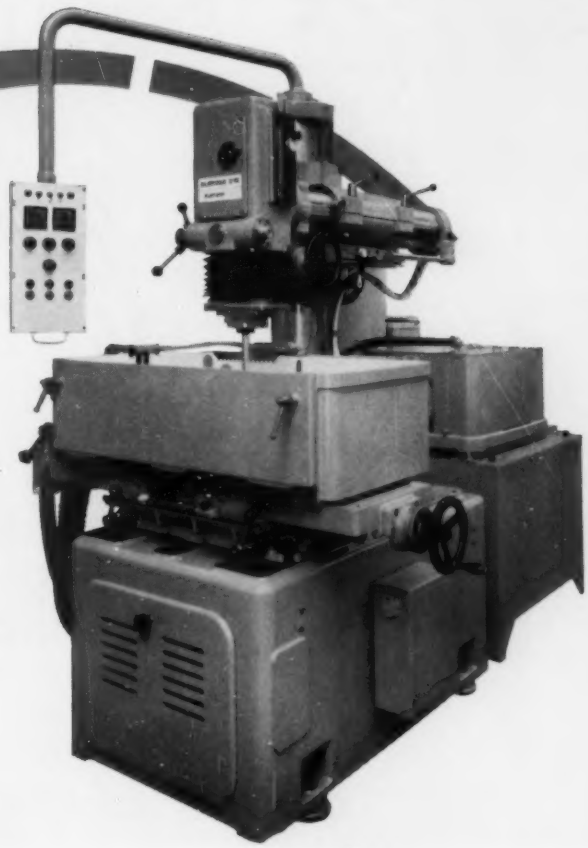
1528 Walnut Street, Philadelphia 2, Pa.
*Houdry means Progress...through Catalysis

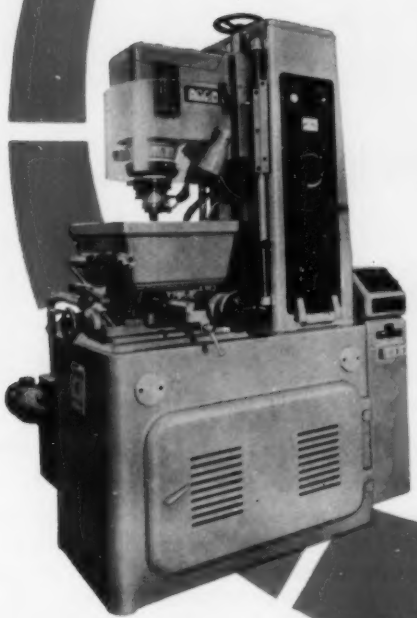
ELERODA D1 & D15

ELECTRICAL DISCHARGE MACHINES

D-15

High Speed: 15 cu. inches per hour.
Unique Versatility: Machines are tailored to fit user's applications.
Hydraulic Servo: Electric Impulse Generator (EPL-500)





D-1

An outstanding precision erosion machine to work and locate with ± .0002". Surface Finish Guarantee 10 micro inches.

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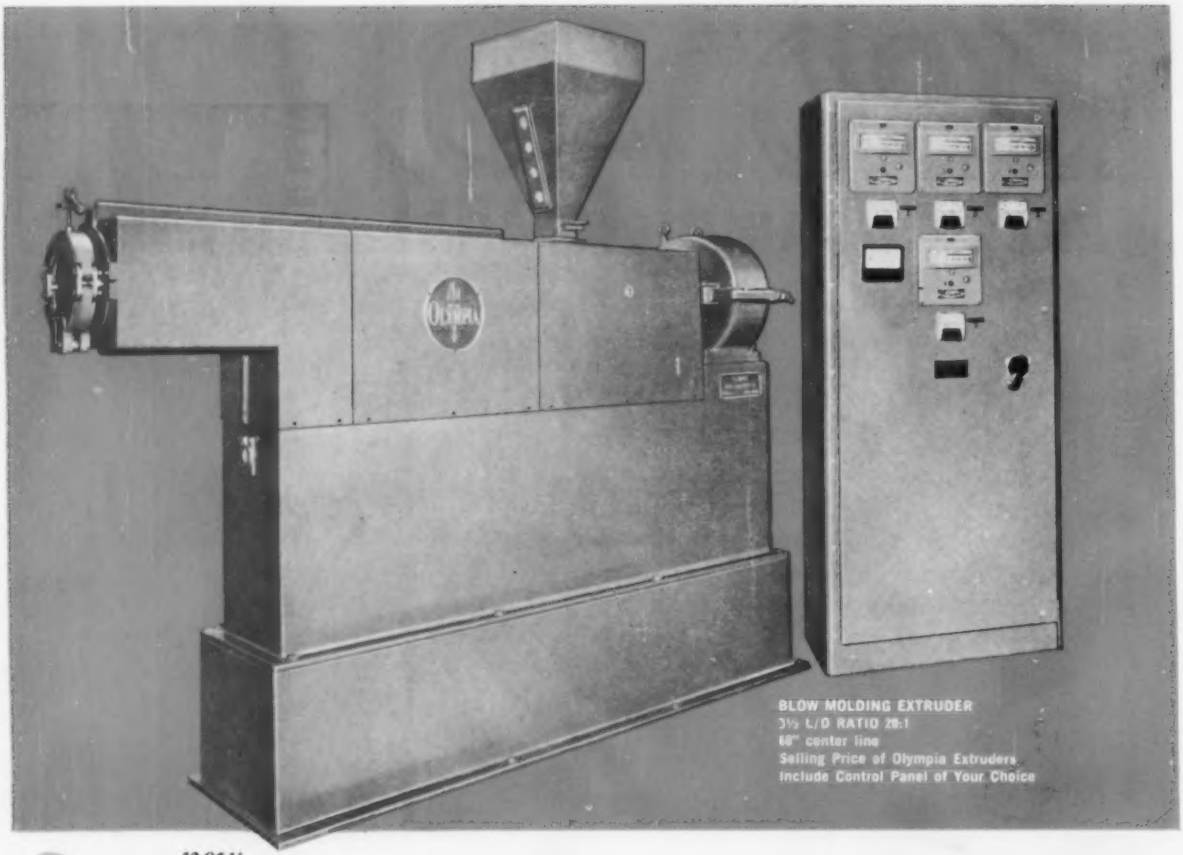
BLOW MOLDING EXTRUDER
3½ L/D RATIO 20:1
60" center line
Selling Price of Olympia Extruders
Include Control Panel of Your Choice

new

OLYMPIA PLASTIC EXTRUDERS

Are backed by 20 years of designing and building experience. Olympia extruders provide...

LONGER EXTRUDING LIFE

- Xaloy 1-piece cylinder construction with no intermediate joints or flanges.
- Extra heavy thrust assembly consists of angular contact thrust and two widely spaced radial bearings housed in high grade Meehanite castings.
- Continuous forced, filtered oil system.
- Flexible coupling between gear transmission and thrust bearing assembly eliminates thermal misalignment.
- Feed Section—high grade Meehanite casting with tangential feed opening, water jacketed to prevent bridging in throat.
- Herringbone gear reducer permits maximum power transmission.

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- Screws—choice of: stellite tip or flame hardened...surface chrome plated... compression ratio to suit your application.
- Heaters—choice of: Mica band, Star Flex or cast-in-aluminum.
- Frictional Control—choice of: cooling coil (grooved in O.D. of barrel) or blowers.
- Control Panel—choice of: Wheelco or West proportioning controllers. Instruments are mounted in cabinet to JIC type standards with full height rear or front opening doors. All wiring complete.

NOTE: *All wiring on the Olympia Extruder is completed at factory.*

COMPLETE LINE SIZES: 1½, 2½, 3½, 4½, 6 L/D RATIOS: 20:1—24:1

Each Olympia extruder is easily adaptable to your specific application

OLYMPIA TOOL AND MACHINE CO.

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OLYMPIA

see
Witco
for

chemicals for urethane foams

Fomrez Polyether Resins
Fomrez Polyester Resins
Fomrez C-2 Catalyst
Witco 77-86 Coupling Agent

Polyether Resins—Fomrez ET-1500, ET-3000, ET-4000 Triols and ED-2000 Diol:

These various molecular weight polyols are available for production of flexible foams for such applications as seats, cushions and upholstery for the furniture and automotive industries; mattresses; crash pads for automobiles and boats; rug underlay; soles for footwear.

Polyester Resin—Fomrez No. 50:

A resin noted for its ease of processing, producing flexible foams of uniform, fine cell structure. Foams prepared from this resin find wide application in crash pads, filters, garment interliners, padding, toys, novelties and household items.

Catalyst—Fomrez C-2:

A stabilized stannous octoate used extensively in the preparation of one-shot polyether foams. Fomrez C-2 is completely uniform from batch to batch, producing good foaming qualities and physical characteristics.

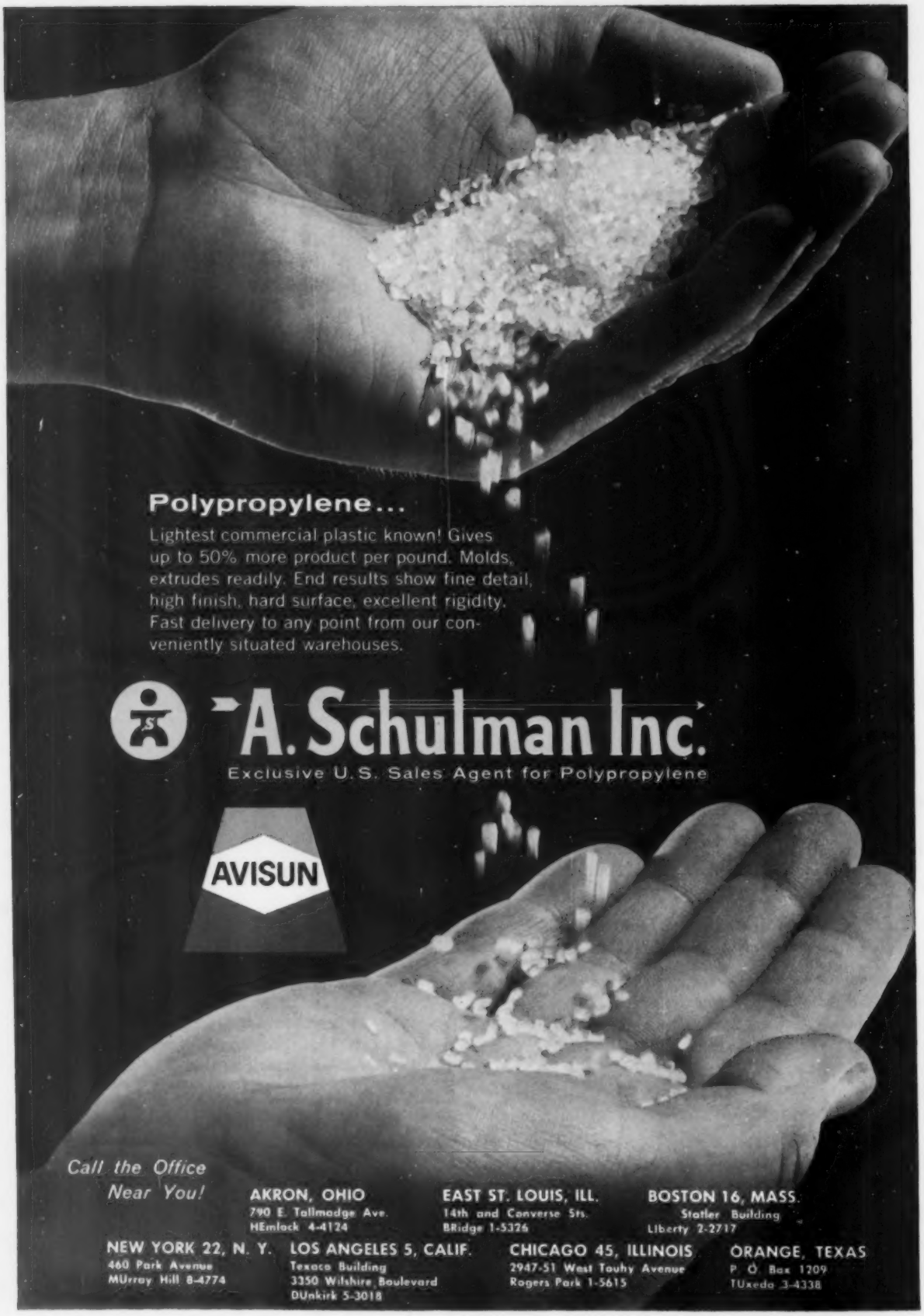
Coupling Agent—Witco 77-86

Specifically recommended for use in Witco Fomrez No. 50 foaming formulations. This coupling agent imparts good processing qualities and enhances physical characteristics of foam.

Witco's application laboratories are at your disposal for help in solving any problems connected with production of urethane foams. No obligation. Just contact your nearest Witco Sales Office.

WITCO CHEMICAL COMPANY, INC.
Urethane Chemicals Department
122 East 42nd Street, New York 17, N. Y.

Chicago • Boston • Akron • Atlanta • Houston • Los Angeles • San Francisco
Montreal and Toronto, Canada • London and Manchester, England.


Polypropylene...
Lightest commercial plastic known! Gives up to 50% more product per pound. Molds, extrudes readily. End results show fine detail, high finish, hard surface, excellent rigidity. Fast delivery to any point from our conveniently situated warehouses.
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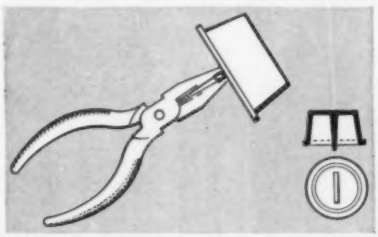
U.S.I. POLYETHYLENE NEWS

A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MAY, 1961 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

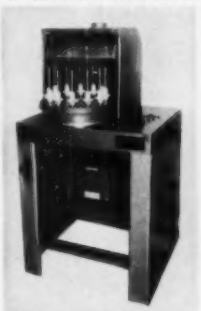
Packaging Notes

Polyethylene pull plugs have fixed place to grip, so they're easy to remove and install with either fingers or pliers. Typical uses, according to the manufacturer, are: protection of pipe; tube and



hydraulic fittings; testing and shipping; sealing dirt-and moisture-catching openings; masking when spray painting, dipping or plating. Sizes range from ¼" to 3"; color is standard "caution" orange. Company also offers polyethylene tube caps, finishing flanges, flat washers.

Electronic bombardment of polyethylene bottles–to make their surface more receptive to printing inks–is claimed to be fast and efficient with an Italian-made machine about to be introduced in the U. S. A. Toys and other hollow polyethylene products, as well as bottles of any size or form, can be treated. Specifications include: output up to 2000 pieces per hour, depending upon product and model; built-in ventilation hood; push-button controls; spring-wire electrodes.



Automatic date and price coder developed specifically for the bakery trade is being marketed as an accessory to the maker's polyethylene bag-sealer. It reportedly stamps each sealed bag clearly and legibly, although package itself may be uneven. Imprinting foot actually moves the wrapped item, so spacing is of no importance.

BE SURE TO VISIT THE
U.S.I. EXHIBIT – BOOTH 304
NATIONAL PLASTICS
EXPOSITION
NEW YORK COLISEUM, JUNE 5-9
NEW YORK CITY

Polyethylene Tomorrow: Theme of U.S.I. Exhibit At S.P.I. Exposition

To Focus On New Opportunities For Profit

For a depth analysis of the problems and opportunities of processing with polyethylene in the years immediately ahead, visit U.S.I.'s Booth 304 at the 9th National Plastics Exposition. The show sponsored by the Society of the Plastics Industry, Inc., will be held June 5-9 at the New York Coliseum.

Market Advances Displayed

U.S.I. will provide dramatic market-by-market forecasts of polyethylene supply and demand through 1963. Specially-constructed displays will show increases anticipated in each of five areas–film extrusion, coating and laminations, injection and blow molding, wire coating and pipe extrusion, and molding with powdered polyethylene.

Breakthroughs Featured

Samples of important new polyethylene products made by the various processing techniques will be on display. Such products, which illustrate the versatility of polyethylene, are contributing substantially to market growth . . . creating new profit opportunities. Typical and on exhibit for the first time: boats molded of U.S.I.'s "Microthene" finely-divided polyethylene resin. Other items show applications ranging from packaging to construction to toy and novelty products.

Technical Experts to Interpret

U.S.I.'s technical service representatives and market analysts will be on hand to answer questions and interpret trends. These experts have the know-how to help solve production problems and help guide processors to maximum profit.

Products Arrive As Shipped In Polyethylene-Lined Mailing Bags

Polyethylene-lined mailing bags are ideal for shipping samples or small quantities of products requiring moisture protection or retention. Dehydrated food, flour and chemicals are examples of the former; plant food, of the latter. Filling is manual or automatic. Liner, which extends slightly above bag mouth, is banded, wire-tied, or heat-sealed closed; then pushed down into cotton outer bag.

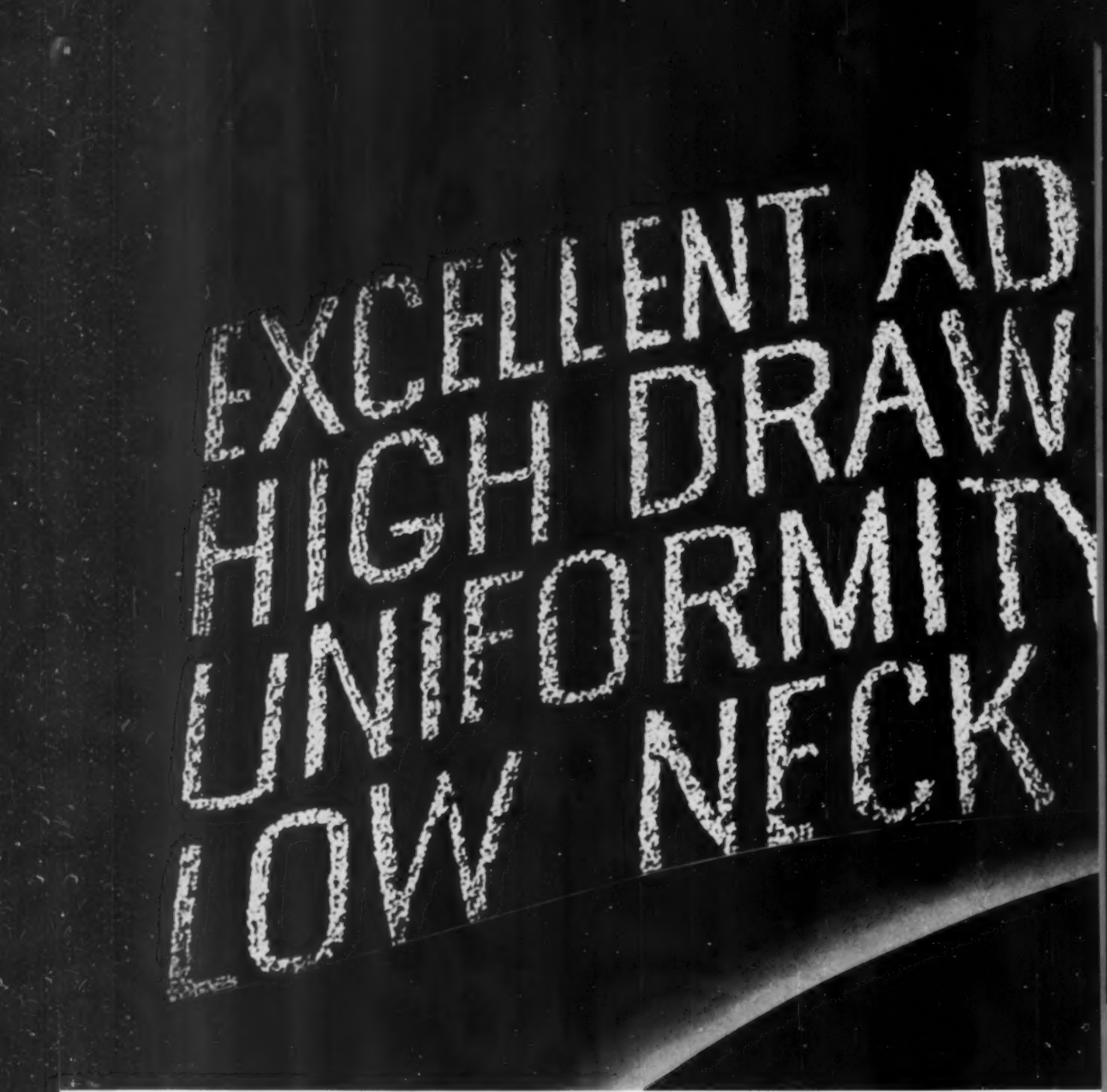
U.S.I. To Participate In British Plastics Show

New equipment will be U.S.I.'s main attraction at INTERPLAS 1961, the British Plastics Exposition to be held at the Olympia, London, England, June 21-July 1. U.S.I. will occupy Booth B-209, on the first floor of Hall B (National).

On center stage will be the "MA Packaging System" which provides inexpensive, in-plant packaging for a variety of products. This system shows promise of increasing the market for polyethylene film. The M A System utilizing a shrink tunnel will be packaging the International Edition of the New York Times as a gift to visitors to the booth.

Samples of other polyethylene products, too, will be shown: blown and cast film; rolls of polyethylene-coated substrates–foil, paper, polyester and cellophane; injection molded products; such new blow-molded items as a miniature wine flask, toy doll parts and garden ornaments.

Also offered for the first time will be a new edition of U.S.I.'s detailed processing guide for all polyethylene processors. It is published in English and will soon be available in German and Spanish as well.



THE ONE COATING RESIN YOU CAN'T BEAT FOR PROCESSABILITY... AND VERSATILITY—PETROTHENE® 205-15 POLYETHYLENE

At last . . . one coating resin that offers the properties most wanted by both extruders *and* users of coated substrates. It's U.S.I.'s PETROTHENE 205-15 polyethylene resin (density 0.924, melt index 3)—an easily-handled, good-working resin which adheres exceptionally well to a wide range of porous and non-porous substrates.

High greaseproofness at economically low coating weights is an outstanding characteristic of the new resin. It reaches 100% passage of Military Specification MIL-B-121B at lower coating weights than other polyethylene resins of similar or even higher density.

Good flow characteristics make PETROTHENE 205-15 adaptable for medium and high speed coating. Coatings as thin as 0.5 mil can be applied; however, thicker coatings are normally recommended to attain desired properties. Neck-in is reduced to a minimum and polymer build-up virtually eliminated. Treatment, in applications which require printing, can be carried out in line at high production speeds.

Here are some reasons why PETROTHENE 205-15 is used in these applications: Multiwall bags – moisture vapor resistance, low beading; foil – good adhesion, heat sealability, low beading; bakery and frozen food cartons – greaseproofness; cellophane – adhesion, heat sealability; military packaging – greaseproofness, heat sealability.

PETROTHENE 205-15 has the best balance of properties of any polyethylene coating resin commercially available. U.S.I. offers a variety of extrusion coating resins to fit any specific requirements. For more information on PETROTHENE 205-15 polyethylene or other coating resins, write or phone U.S.I. today.

PETROTHENE 205-15 POLYETHYLENE

FOR Cellophane • Polyester • Glass Fibers (Scrim cloth) • Foil • Paper • Paperboard • Acetate • Parchment

HAS Excellent Adhesion • High Drawn-Down • Uniformity • Low Neck-In

PROVIDES Low Moisture-Vapor Permeability • High Greaseproofness • Good Heat Sealability • High Chemical Inertness • Economy • Versatility

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

Series VI, No. 3

POLYETHYLENE PROCESSING TIPS

TRANSMISSION OF MOISTURE VAPOR THROUGH POLYETHYLENE FILMS AND COATED PAPER

Polyethylene film and coated paper are often selected as packaging and construction materials principally because they provide a moisture barrier.

In packaging hygroscopic materials such as powdered foods, sugar, flour and dry chemicals, moisture pick-up must be prevented. Metals, too, require protection from moisture, which accelerates corrosion.

In construction work, polyethylene film and coated paper are used to seal off moisture under buildings, in sidewalls, and under concrete floors and driveways.

In some cases, moisture *loss*, rather than pick-up, may be the problem. Bread and baked goods need moisture to remain fresh. Cellulose sponges are packaged damp to keep them soft and pliable, and this moisture must be retained during the shelf life of the package.

Conditions Determine Requirements

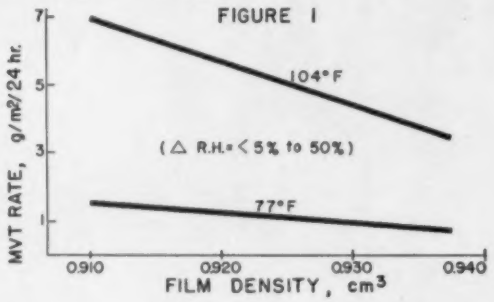
For any packaging application, the required degree of resistance to moisture penetration depends on the nature of the product and where it is stored and used. In selecting a particular polyethylene film or coated substrate, one should consider: (1) the amount of moisture gain or loss allowable through the polyethylene and (2) the environmental conditions which will be encountered. These will determine the permissible moisture vapor transmission rate for the film. With many products, moisture barrier requirements may be so non-critical that any polyethylene film or coated substrate that can be used to package them will also provide a satisfactory moisture barrier. With many packages, seams, corners, or stitching may be a bigger factor with respect to moisture vapor transmission than the barrier properties of the polyethylene itself.

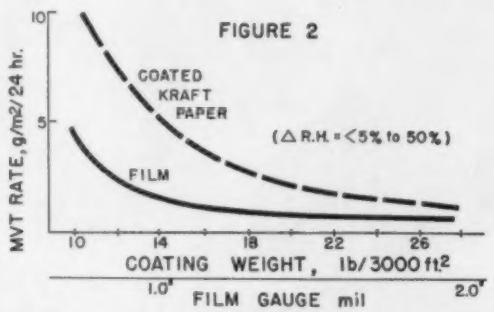
Factors in Moisture Vapor Transmission

By definition, moisture vapor transmission (MVT) is the rate of water vapor permeation through a barrier under given conditions of temperature and relative humidity. MVT is measured in grams of water vapor penetrating one square meter of film or coated paper in 24 hours. Test conditions (ASTM E 96-53T) call for 73°F temperature, with 50% relative humidity on one side of the sample and less than 5% on the other.

Figure 1 shows the effect of film density and environmental temperatures on the MVT rates of 1-mil film. To decrease the MVT rate, it is necessary to increase film density or decrease the environmental temperature.

Figure 2 shows the effect of film thickness and coating weight on MVT for polyethylene resins of .920 g/cc density.





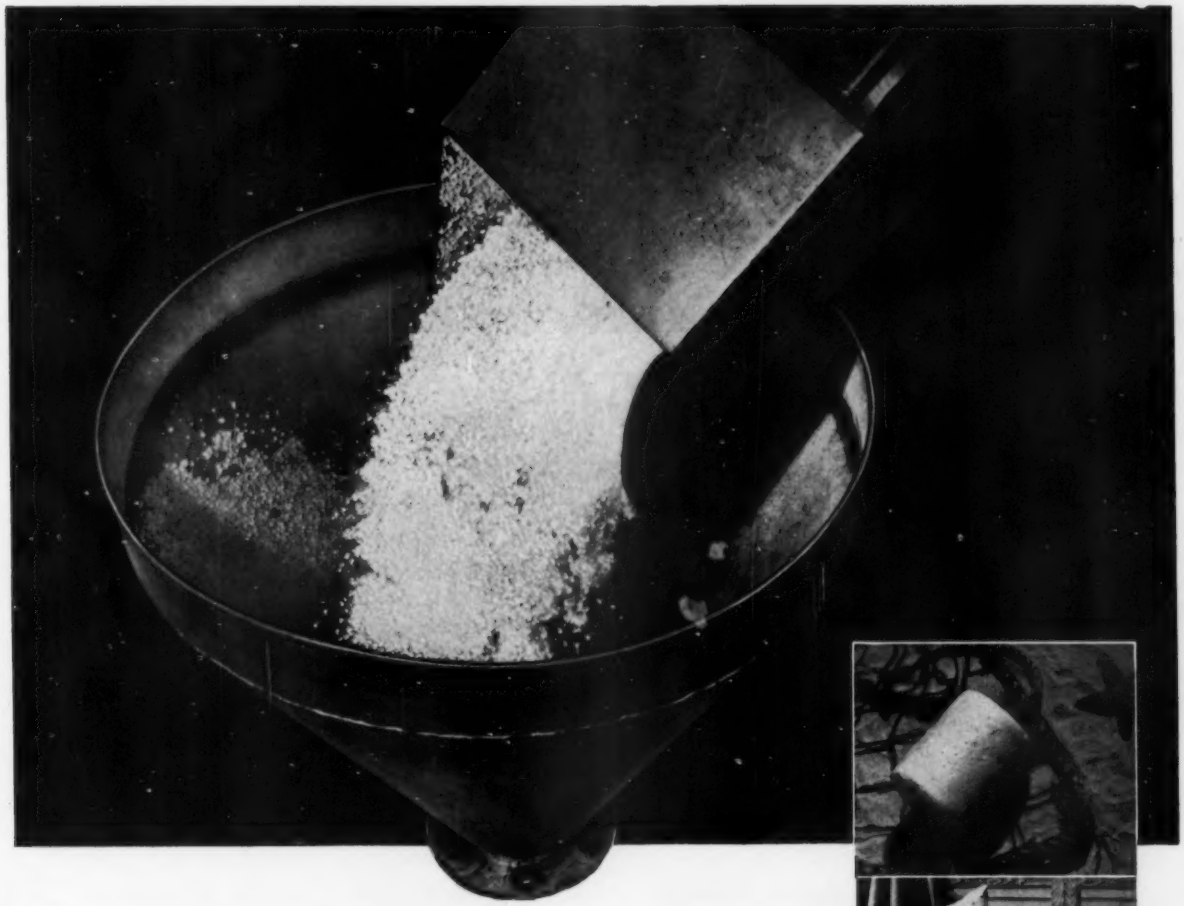
The higher vapor transmission of coated paper is due primarily to "wicking," for at low coating weights paper fibers may extend through the thin coating. At higher coating weights, "wicking" will not occur, and polyethylene films and coatings of equal thickness will have essentially the same MVT rates. Barrier properties of the substrate are also important. Foil, for example, has a very low MVT rate and is often used in laminated materials for critical military packaging.

The greater the difference in relative humidity across the barrier, the higher the MVT rate. Thus, dry packaged materials will need more protection in high-humidity environments. MVT rates vary linearly with the difference in partial pressures of water vapor across the barrier, except for thin coatings where "wicking" may occur.

U.S.I. Help on MVT Problems

Greater economy may well result from use of the proper film density and thickness. For assistance in finding the best resin or film for given applications, contact the nearest U.S.I. Sales Office. Your problem will be referred promptly to U.S.I.'s Technical Service Department.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



Uni-Crest Expandable Polystyrene Beads

Excellent for a wide variety of products and applications in packaging, low temperature insulation, panel construction, refrigeration, flotation, novelties and toys.

United's Uni-Crest is ideally suited for products demanding high insulating efficiency, low moisture absorption and light weight. It is non-toxic, non-abrasive, non-dusting, shock resistant and has exceptional permanence and strength.

Uni-Crest beads are available in both regular and self-extinguishing types. Write for more specific information and a free sample.

The following information is furnished as a general guide to the properties of Uni-Crest, *using samples with densities of 1 and 1.25 lbs./cu./ft.*: Specific Gravity — 0.02; Compression Strength — 16-20 lbs./sq. in.; Energy Absorption (max.) — 29.66 in. lbs./cu. in.; Tensile Strength — 44.46 lbs./sq. in.; Bending Strength — 28.5 lbs./in. of width; Hydrogen-ion Concentration — neutral; Water Absorption — less than 2%; Water Vapor Transmission Rate — 7.9 grams/sq. meter/in./24 hrs. — 0.47 grains/sq. ft./in./1 hr.; Coefficient of Expansion — .00002676; Thermal Conductivity (K factor) BTU/hr./sq. ft./°F/in. — 0.23 at mean temperature of 40°F.

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High-impact graft-copolymer for extrusion and molding; fast setting.

MACROLENE 6415
High-impact graft-copolymer for extrusion and molding, all-purpose—good flow.

MACROLENE 7315
High impact graft copolymer for extrusion and molding; superior flexural and impact strength—excellent flow.

MACROLENE 555
Super impact graft copolymer for extrusion and molding, exceptionally high flexural and impact strength.

MACROLENE 4615
Medium impact graft copolymer, greater flexural and impact strength, less clarity.

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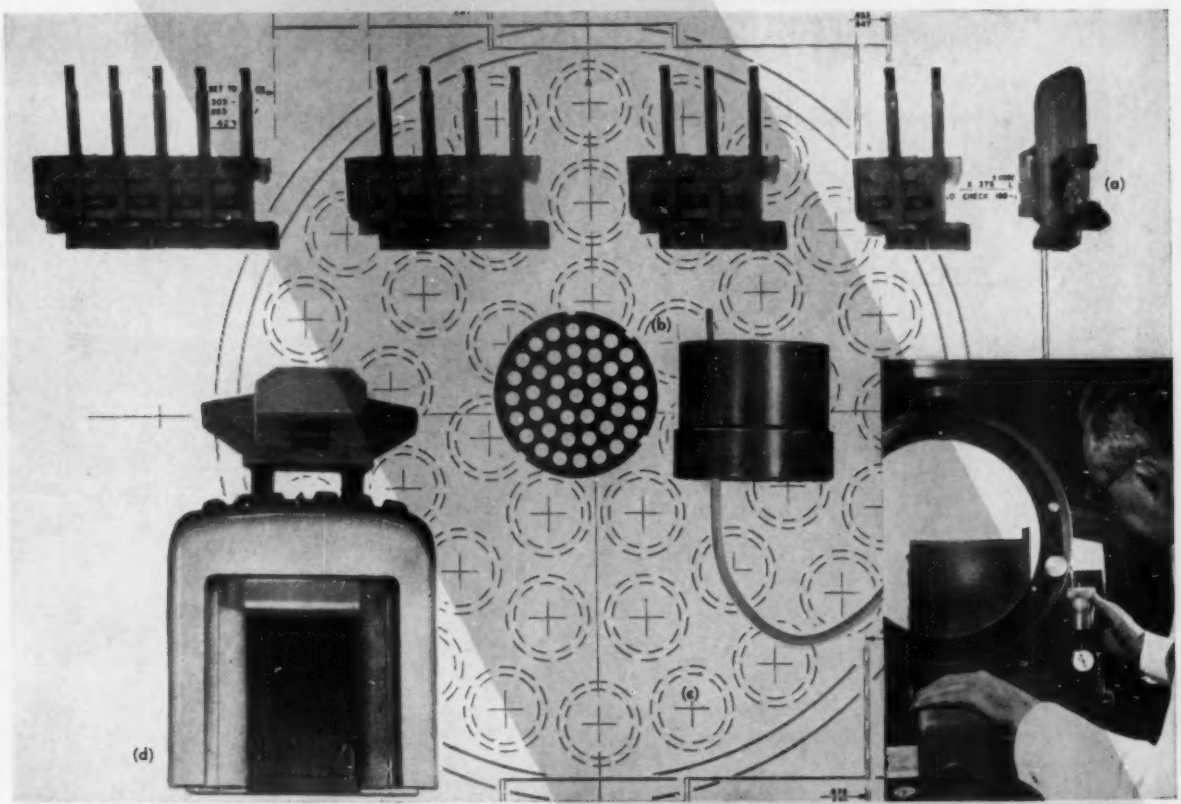

(a) A series of crab locks molded from Nylon.
(b) Electrical connectors for making and breaking as many as 41 electrical circuits at one time are used in missile tracking equipment.
(c) Comparator chart in background enlarges connectors 10 times and checks the accuracy of all holes and insets.
(d) Pick-up head for stereophonic record player. This is a complicated but very small part (one third the width shown) in which three insets are molded into the head.

That's a strong statement but a very important one to remember in planning any type precision molding project. Haveg works with every known material to provide the most economical moldings . . . with properties necessary to meet the most rigid specifications.

Today Haveg is literally making design dreams come true . . . through its extensive research and development laboratory facilities as well as the best quality control laboratory within the industry.

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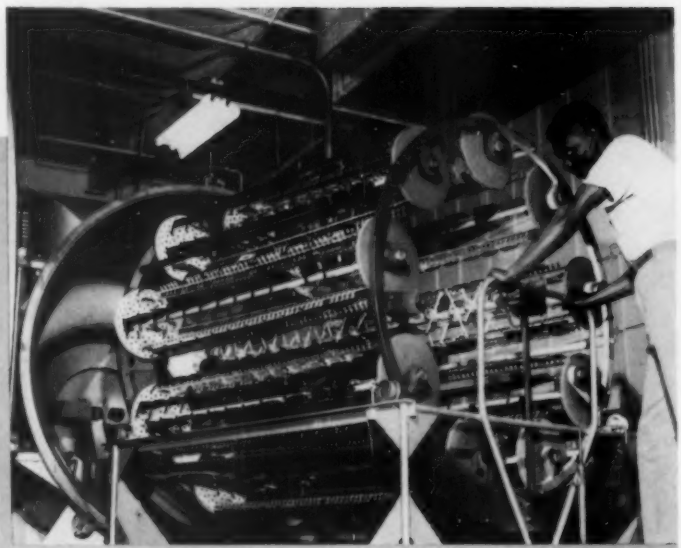
A coater to handle greater volumes of molded plastic automotive accessories was a must for this leading manufacturer in the plastic injection molding field, in addition to other coating equipment.



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* cycle time reduced by half — from 40 to 20 minutes
* controlled moisture conditions — less humidity problems
* delivery schedules met as planned
* greater simplicity of operation
* complete dependability — unit less subject to breakdowns

With the NRC coater, G. Felsenthal & Sons is now equipped to handle large finishing orders — large in size or quantity. If efficient vacuum coating of plastic parts — large or small — is in your present or future operating plans, write or phone us today. We'll be glad to help.

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If you find yourself in the "cut cost — keep quality" squeeze (and who isn't these days), you can expect real help from Plastolein 9720. This is because 9720 contributes the quality characteristics of a polymeric, yet is the *lowest* cost polymeric available today.

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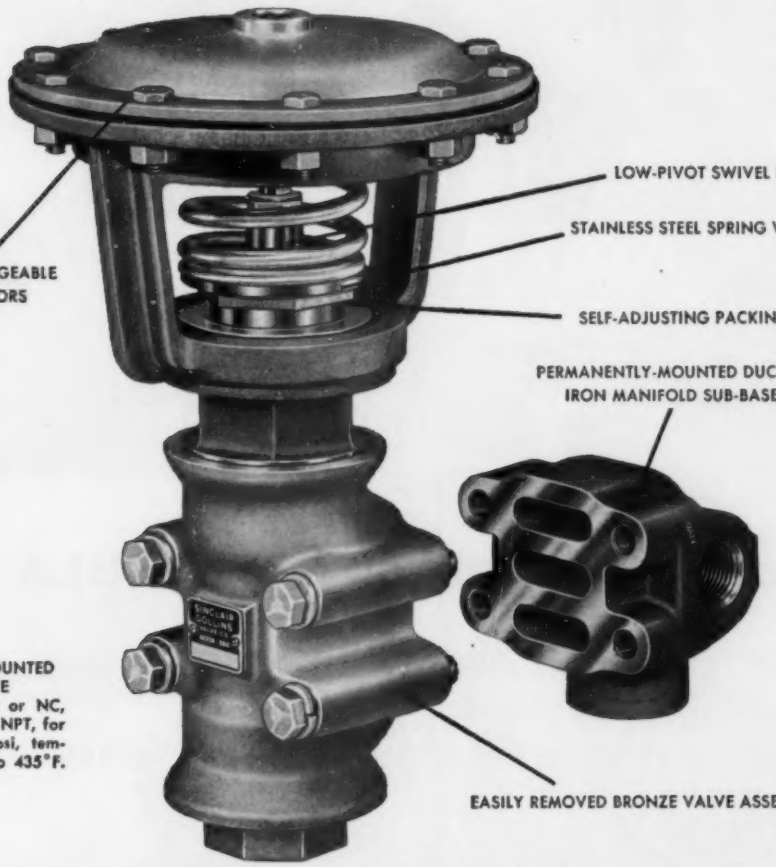
NEW—SINCLAIR-COLLINS

1/2" manifold-mounted steam valve



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2- and 3-way NO or NC, tapped ½- or ¾-in. NPT, for pressures to 350 psi, temperatures from 0 to 435°F.

Want excellent flow characteristics and bubble-tight sealing? Want maximum service life and minimum downtime for maintenance? Want compact, versatile design and ease of installation? Then you'll specify Sinclair-Collins' new manifold-mounted steam valve.

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What's more, S-C's new valve can be converted from NO to NC, or vice versa, by rotating it 180° on the manifold sub-base.

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Find out how this advanced design valve can improve the performance of machines you have in service or on the drawing board. Your Sinclair-Collins field engineer has all the details.

For more information, write for free Bulletin MV-60. Address The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, Ohio, Dept. MP-561.

The SINCLAIR-COLLINS VALVE Co.
A DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)
AKRON 11, OHIO

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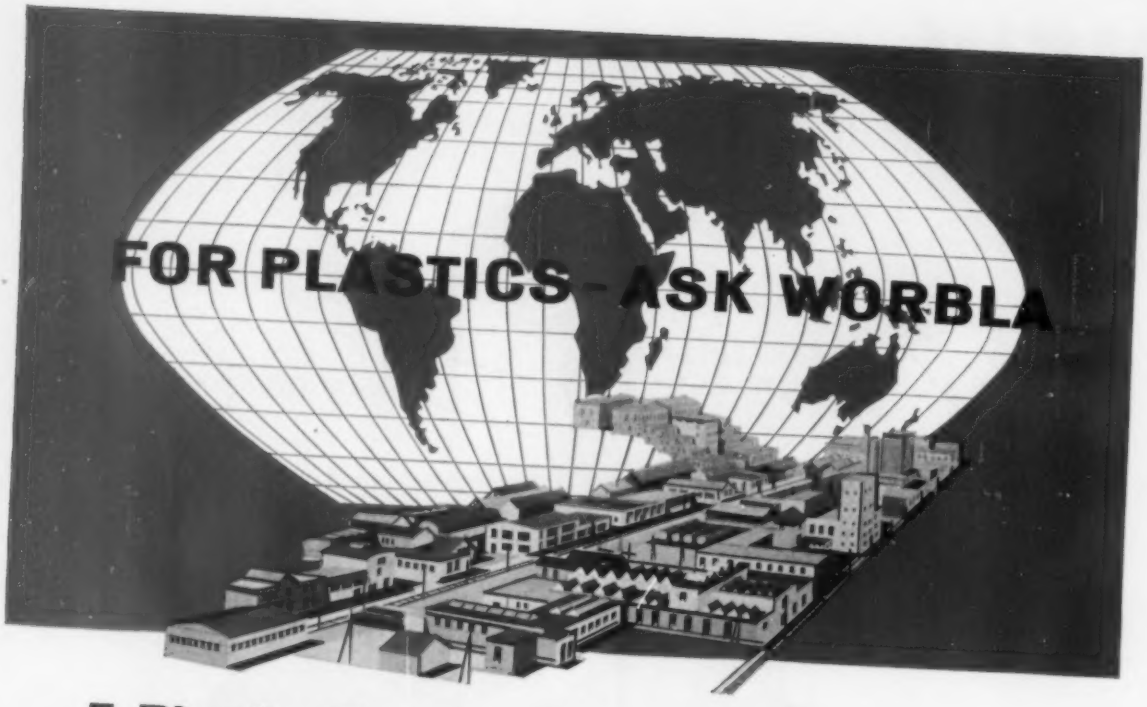

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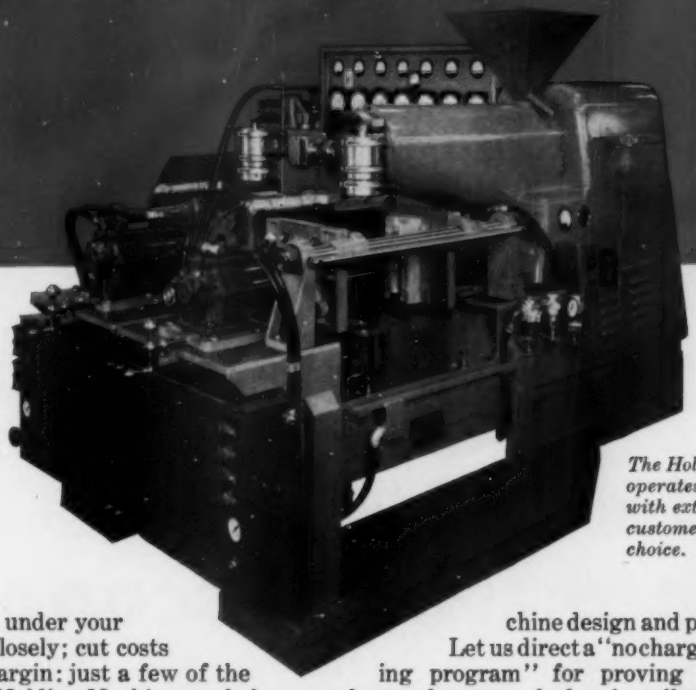

The Holoform machine operates in conjunction with extruder of customer's choice.

Put that plastics operation under your own roof; control quality closely; cut costs and increase your profit margin: just a few of the things the Holoform Blow Molding Machine can help you do! Designed to permit manufacturers to centralize production, the Holoform Automatic is versatile, easily adapts to every sort of product—squeeze bottles, dolls, toy parts, flexible hoses, large and small containers, handles . . . the list is virtually endless.

Bring your problem in plastic molding to the experts. An organization with a wealth of experience in machine design and plastics research.

Let us direct a "no charge operator training program" for proving machine, mold, product and operator before installation at the plant.

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wide range — molds 6 oz. to 5 gal. containers; blow and/or vacuum combination forming; cushioned cylinders prevent mold slam — save wear; wide adaptability to auxiliary equipment; easy operation; and other unique advantages.

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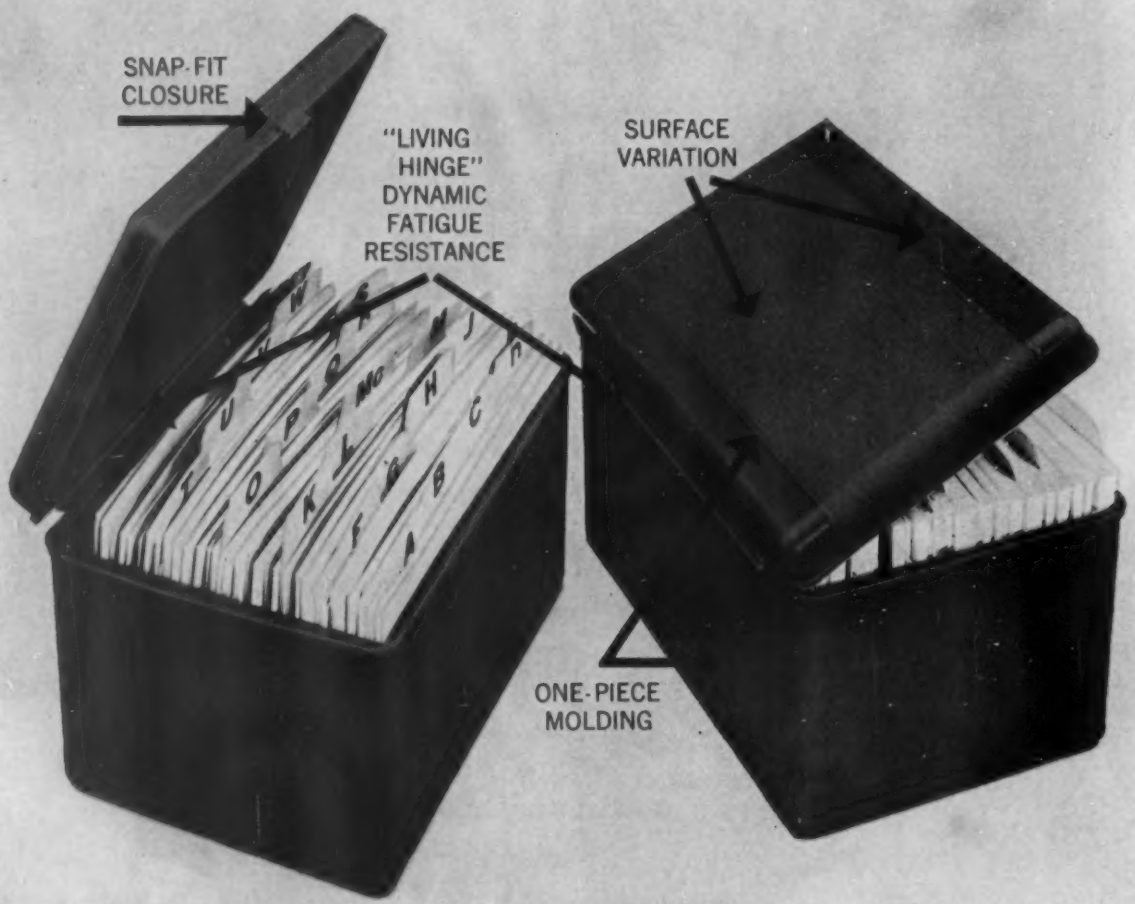
WHAT'S NEWS IN PLASTICS



File box with "living hinge" shows design versatility of Escon® polypropylene

A "living hinge" with extraordinary life, snap-fit closures to replace metal parts, various surfaces—gloss, matte or textured—these are just three of the countless design possibilities when you mold with versatile Escon polypropylene. Testing of "living hinges" was discontinued after 1,300,000 flexes without signs of weakening.

Escon polypropylene offers molders a balanced combination of properties for high-speed, continuous production. These include resistance to acids, alkalies and corrosion; high strength; low volume cost; negligible water pick-up; high heat distortion point; excellent electrical characteristics; abrasion resistance; easy processing and many more. For technical assistance, write to Enjay at 15 West 51st St., New York 19, N. Y.

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MODERN PLASTICS

May 1961 **Volume 38, Number 9**

How to get the most out of plastics shows

The National Plastics Exposition in the United States is held every 2½ years, alternating between New York and Chicago. The West German show is held every 3 years, the British show every 2 years. This year there are other plastics shows in Belgium, Denmark, and Canada, plus plastics sections of general industrial and trade shows in Japan, in Italy, and elsewhere.

Truly a year of plastics expositions, also a year of vast international travel by plastics industry people who will visit more than one show.

An important question is how to get from these shows and conferences the greatest return possible for the cost of attending.

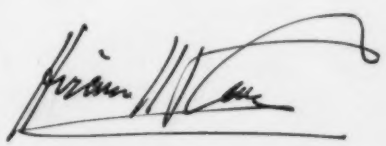
The program outlined by W. F. Rockwell Jr., President of Rockwell Mfg. Co., in one of his recent "Rockwell Reports," makes sense to us.

First, the company holds breakfast meetings, prior to and during such industry trade-association events, for all of its attending people.

"This," says Mr. Rockwell, "gives us the opportunity to review with them the changing nature of the industry and of our business, to highlight those features of the meeting we feel are of particular interest. We encourage each man to plan his activities before the convention gets under way, to plan attendance at key meetings and functions, to contact key customers and prospects, to review his knowledge of every important matter that is likely to present itself during the convention.

"In other words, our attitude on trade shows and conventions is exactly the same as it is in any other area of our business. If the job is worth doing at all, it's worth doing in such a way that the company will derive the greatest benefit. It cannot be justified on any other basis."

You can start your planning now, by the use of this issue of MODERN PLASTICS.



Floor plan, list of exhibitors, and conference program, New York show ..... **p. 131**

List of exhibitors and conference program, London show ..... **p. 183**

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Overseas trends, starting on ..... **p. 139**

U. S. trends, starting on ..... **p. 161**

THE WIDE WORLD

In June, at three major expositions in America, in England, and in Belgium, there will be offered more new concepts in product design and application, more new processing equipment and techniques, than ever before in a single month. At the accompanying conferences new ideas will be presented on the formulation, uses, and processing of plastics.

Why should this month of June, 1961 be so important to the plastics industry, world-wide? Because the plastics industry is the most truly international industry ever built, plastics are the most truly international materials ever known, and mankind is at a new crossroads in history—in politics, in trade, in industry.

In the past 15 years, 22 new nations have been born, spun off from the old empires. All these nations need plastics and many can produce plastics raw materials. The same plastics can be made from coal, petroleum, natural gas, and even agricultural wastes,

OF PLASTICS

the choice depending on availability and processing economics. And in plastics there is today a wider range of available properties than in all other materials combined, making one or more plastics materials suitable for use in any earthly clime, or even in outer space.

Most plastics are, at the same time, materials for automated mass production of fantastic quantity and materials amenable to hand work in a cottage industry.

Plastics can be combined with, or added to, any and all other materials known to man in order to improve their properties. And while other materials, especially metals, advance in price around the world, the prices of plastics have been coming down.

Communications in the plastics industry, world-wide, are second to none. Its industrial press, its association structure, its conference arrangements, and its exposition organizations all help to create a condition under which techniques and applications developed in one country rapidly become internationally available.

Thus, plastics become established as the world's first "common denominator" materials—to be made out of many basics in many ways; to be processed in many techniques; to be the hope of the burgeoning world populations for higher standards of living—for employment and for enjoyment. At this new crossroad in history, plastics are significantly involved in man's future—everywhere!

Against this background of world-wide interests in its materials, applications, and technological development the world plastics industry faces the month of June 1961, and the plastics expositions. What shall we look for?

Applications: four main fields

In applications, the building field will probably show the most spectacular products. From Germany, Belgium, and Italy: continuously extruded rigid vinyl sheets and laminates flat and corrugated; closed-cell rigid vinyl foam sandwiched between vinyl sheets or vinyl-metal laminates for doors and panels. From the United States: self-extinguishing styrene foam panels, skinned with polyester-glass, now actually in commercial production. From the U. S. and England: new acrylic building components including cast sheets with fabulous embedments. From everywhere: epoxy caulking materials, spray-up roofs, cinder-block finishes. And chiefly American developments: new concepts in plastics in lighting; rigid vinyl window and door frames; reinforced plastics sanitary equipment; and film laminates on plywood, chipboard, plasterboard, and metals.

The second area of interest in plastics applications at the shows will undoubtedly be the transportation field, especially automotive uses. Included will be nylon mechanical parts, melamine industrial laminates, acetal instrument clusters, foam combinations, decorative poiyester film-vinyl trim, and even a completely thermoformed sandwich roof. In the aircraft applications reinforced plastics, honeycombs, and foams will be stressed.

Other forms of transportation such as boats will evidence progress made in the U. S., in England, and in Holland. Trailers, both house and travel,

SALES OF PLASTIC MATERIALS[a]

(in metric tons[b])

COUNTRY	1957	1958	1959	1960
U.S.A.	1,932,000	2,050,000	2,489,000	**2,730,000***
GERMANY	546,500	628,600	805,000*	**900,000***
UNITED KINGDOM	397,000	424,300	500,000*	**580,000***
JAPAN	221,000	290,000	360,000*	**546,000*[c]**
FRANCE	182,589	232,246	272,000*	**312,000***
ITALY	134,379	165,250	200,000*	**240,000***
U.S.S.R.	242,300	(N.A.)	(N.A.)	**(N.A.)**
OTHERS[d]	334,200	709,600	774,000	992,000
WORLD	4,000,000	4,500,000	5,400,000*	**6,300,000***

[a]Charts from Industrial Research Magazine, courtesy of Arthur D. Little, Inc.
[b]Metric ton equals 1000 kg. or 2.204 lb. av.
[c]Capacity [d]1958-1960 figures include U.S.S.R. *Estimated

will come in for some attention from the standpoint of materials and design.

Plastics in home appliances will probably be the third point of interest. When one considers that the floor scrubbers and rug shampoo devices introduced in 1960 accounted for almost 32 million lb. of resins, the importance of these developments is established. Thinner-walled refrigerators and more efficient washers are also involved.

Furniture will prove at the shows to be a greatly expanding market for plastics. Propylene and high-density polyethylene, styrene, urethane and vinyl foams, reinforced plastics frames, and metal-plastic laminates are all part of the new trend in furniture.

The population explosion everywhere makes school furniture and public transportation seating one of the fastest-growing markets to open up for plastics materials.

Fourth point of interest in application will be packaging. What was done in detergent bottles can be done soon in bleach bottles. The market will then open for oil containers with new ideas and new materials. Among the films in packaging a series of major battles has begun and it will be of interest to study the flow of these battles. Particularly will new methods of producing packages in huge quantity and at low cost be in evidence.

New applications in housewares, toys, sporting goods, luggage, and a host of other fields will, of course, appear at the shows.

PLASTICS CONSUMPTION BY COUNTRY

(pounds per capita)

COUNTRY	1956	1958	1960 (est.)
U.S.A.	22	23.4	**27.2**
Germany	17	24.2	**29.6**
United Kingdom	10.8	14.1	**17.4**
Japan	4.1	7.2	**11.0**
France	7.8	13.0	**16.5**
Italy	4.2	7.2	**11.0**

At the shows: the thermoplastics

Taking each of the plastics materials in turn, here is what may be expected to be learned:

In thermoplastic materials the trend throughout is towards the more sophisticated copolymers and alloys, and toward the newer precision engineering plastics which compete with metals. There is also a trend whereby every material maker will have a variety of resins, because modern end-use products contain several kinds of plastics with special properties.

ABS polymers. Three new sources, making five to date, are expected to promote these materials into many new uses. Blow-moldable ABS is ready for the market, to supplement the olefins. Higher heat resistance, higher tensile and impact strengths, better color and lower price are all important factors.

Acrylics. At least two more makers will announce their entry, with one or more new processes involved. A thermoset acrylic is expected to be shown as well as a new acrylic-polyester alloy. Acrylic films may be shown.

Acetal resins. Another maker has already announced. Watch for a number of new U. S. and foreign applications in cameras, automotive parts, electrical parts, home appliances. Some of these parts are pin-point tiny, others are huge in area and weight.

Cellulosics. Higher-acetal formulas with greater dimensional stability will be present. Also blow-molding cellulosics and paper-coating versions.

Nylons. Following a trend in Europe, polycaprolactam nylon in large moldings will be stressed. Possibly a nylon film for skin pack will be ready in time. Nylon-6/6 in machine and automotive parts, sporting arms parts, and hardware will be shown.

Pentaerythritol resins. On display will be a complete chemical processing system with every part—tank liners, pipe, valves, **(To page 270)**

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. . . . *the Rapid Registration Card below will do it!*

Remove the complete card, and fill in the information required on the reverse side. Then bring it with you to the New York Coliseum, present it at the Registration Desk with your registration fee, and you will be in the midst of the Exposition's displays a few seconds later. There is much to study and compare in this greatest of Plastics Expositions. The card below will help you make the most of it.

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Tuesday	1 PM to 6 PM
Wednesday	1 PM to 6 PM
Thursday	1 PM to 9 PM
Friday	1 PM to 6 PM

CHILDREN NOT ADMITTED

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New York Coliseum -- June 5-9

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9th National Plastics Exposition

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For additional tickets and information write to: The Society of the Plastics Industry, Inc., 250 Park Avenue, New York 17, N. Y.

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9th National Plastics Exposition

NEW YORK COLISEUM, NEW YORK, N. Y., JUNE 5-9, 1961

and 1961 S.P.I. Annual Conference

COMMODORE HOTEL, NEW YORK, N. Y., JUNE 5-8, 1961

S.P.I. Annual Conference Program

(All sessions held at the Commodore Hotel, unless otherwise noted)

Monday, June 5

1:00 P. M. — Registration

Tuesday, June 6

9:00 A. M. to 12:00 Noon — 4 Concurrent Sessions

Session I. Plastics in Building (Grand Ballroom)

SECTION 1. *Plastics Applications.* Moderator: W. H. Scheick, American Institute of Architects.

"Architectural Needs and Applications for Plastics Including Existing Applications and Future Needs"

"A Builder Looks at Plastics"

"Time and Use vs. Plastics"

"Plastics Role in Lighting"

Panel discussions will follow each of the above.

SECTION 2. *Codes.* Moderator: Frank Ambrose, Alsynite Div., Reichhold Chemicals, Inc.

"Problems & Opportunities in Building Codes"

"Codes at the Local Level"

"BOCA's Experience with Plastics"

Panel discussion of above three subjects.

Session II. Plastics in Communications (East Ballroom).

Moderator: J. V. McBride, The Plastic Wire & Cable Corp.

"Plastics in the Recording Arts"

"Plastics vs. the Elements in Telephone Communications"

"Plastics in the Space Environment"

"Plastics in Radio, Television, and Computers"

Question-and-Answer period after each of above.

Session III. Plastics in Machinery (West Ballroom).

Moderator: A. J. de Matteo, Consultant.

"New Developments in Machinery for the Thermoforming Industries"

"New Developments in Blow-Molding Machines"

"New Developments in Extruders"

Session IV. SPI Thermoplastic Structures Division (Windsor Ballroom).

Theme: *The Uses and Techniques for Fabrication of Rigid Thermoplastic Structures.* Introduction: Paul Chamberlain, Industrial Plastic Fabricators, Inc.

"Applications of Polyolefin in Structures in the Chemical Process Industry"

Color Movie: "The Manufacture and Fabrication of Polyolefins in Europe"

"Welding, Heat Sealing, and Cementing Techniques used in the Manufacture of Thermoplastic Structures"

"Fabrication of Plastics for Corrosion Control"

6:00 P. M. to 8:00 P. M. — Reception

Wednesday, June 7

9:00 A. M. to 12 Noon — 4 Concurrent Sessions

Session I. Plastics in Packaging (Grand Ballroom).

Theme: *Plastics for Profits.* Moderator: Lloyd Stouffer, "Modern Packaging" magazine.

"Present and Future Penetration of Plastic Packaging in 14 Major Markets"

"Flexible Plastic Packaging Films"

"Plastic Bottles, Tubes, and other Merchandising Packages"

"Rigid Plastic Nestable Containers"

Session II. Plastics in Automotive (East Ballroom)

Moderator: Hartley Barclay, Publisher "Automotive Industries."

"Current Uses and Requirements"

"The Purchasing Agent Looks at Plastics"

"The Role of the Processor"

"Looking to the Future"

Panel Discussion and Question-and-Answer Period.

Session III. SPI Vinyl Dispersions Division (Windsor Ballroom).

Introduction of Speakers: Frank W. Caplan, Reynolds Chemical Products Co.

"General Introduction to Vinyl Dispersions"

"Uses of Vinyl Dispersions – Present and Future"

"Role of Custom Formulator in the Vinyl Dispersions Industry"

Panel discussion and Question-and-Answer-Period.

Session IV. SPI Epoxy Resin Formulators Division (West Ballroom).

Theme: *Breadth and Scope of Epoxy Applications.*

Moderator: Donald Roon, Hysol Corporation.

"Adhesives"

"Electrical"

"Tooling"

"New Applications"

Question-and-Answer Period.

6:00 P. M. to 8:00 P. M. — International Reception United Nations Headquarters

Thursday, June 8

9:00 A. M. to 12 Noon — 3 Concurrent Sessions

Session I. Plastics in Appliances (Grand Ballroom)

Moderator: Gordon Thayer, The Dow Chemical Company.

"Market Goals for Appliances"

"Designing Appliances for Functional Performance"

"What the Appliance Industry Feels it Needs in the Way of Plastics Materials and Services"

"The Bissell Shampoomaster – A Case History"

Question-and-Answer Period after each of above.

Session II. Plastics in Defense (East Ballroom)

Moderator: John K. Honish, Union Carbide Plastics Company.

"Plastics in Weapons"

"Plastics in Over-all Defense"

"Plastics in Ship Construction"

"Plastics in Space & Missiles"

Question-and-Answer period.

Session III. SPI Cellular Plastics Division (West Ballroom).

Theme: *Plastic Foams – at Home – at Work – at Play.* Introduction: Edwin Edberg, Koppers Co., Inc.

"Plastic Foams in Furniture"

"Plastic Foams in Construction"

"Plastic Foams in Transportation"

"Plastic Foams in Defense"

"Plastic Foams in Leisure Activity"

Classified list of exhibits

Alphabetical list of exhibitors

COMING NEXT MONTH

A special on-the-scene report on the

9th National Plastics Exposition

A TEAM OF MODERN PLASTICS editors will be covering the exhibits at the New York Coliseum to pinpoint the newest and most significant of the materials, machinery, and applications on display. Their reports will be written, edited, and released for printing as soon as the show comes to an end – in order that you may receive the report as a special insert in your June issue.

For those of you who attend the show, this report should be a help in organizing and refreshing your impressions of hundreds of exhibits and getting them into proper perspective.

For those of you who will not attend, the report will serve as the best substitute means of keeping up with the important industry advances which will be unveiled at this important exposition.

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Cellulose acetate butyrate . 407
Cellulose nitrate 407
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Polyethylene . . . 223, 304, 535, 933, 1560
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Polystyrene and copolymers 223, 407, 1560, 1610
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Classified list of exhibits

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Acrylic 1005, 1017, 1542
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Resorcinol 1017
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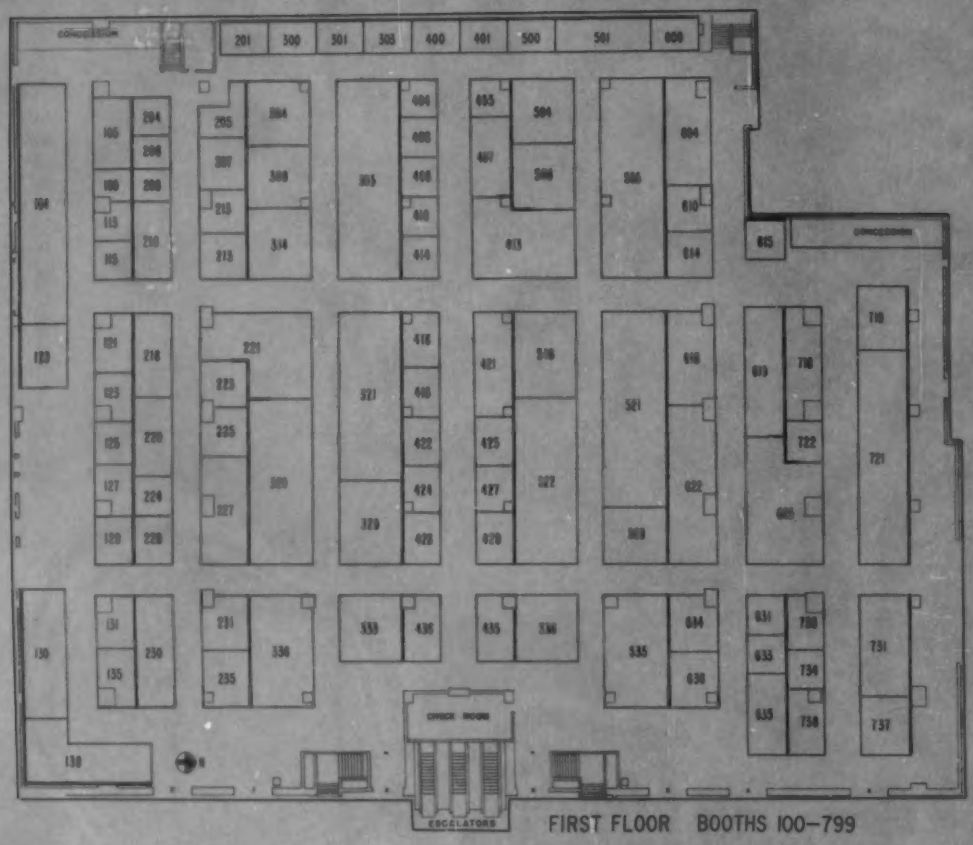

FIRST FLOOR BOOTHS 100–799

Alphabetical list of exhibitors

Exhibitor	Booth No.
A & S Electronic Die Corp., Steel Rule Die Div.	235
Acme Machinery & Mfg. Co., Inc.	604
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American Cyanamid Co., Intermediates Dept.	414
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American Ornapress Corp.	1624
American Renolit Corp.	1545
Antares Instruments, Inc.	1554
Apex Machine Co.	1301
Application Engineering Corp.	113
Argus Chemical Corp.	1704
Arrow-Hart & Hegeman Electric Co.	610
Atlas Vac-Machine Corp.	1135
Aust & Schuttler U. Co.	1405
Automatic Process Control, Inc.	1573
Avery Label Co.	210
AviSun Corp.	1151
B.I.P. Engineering, Ltd.	805
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Baker Perkins, Inc.	321
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Celanese Polymer Co., Div. Celanese Corp. of America	1117
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Chanal Plastics Corp.	734
CIBA Products Corp.	436
Cincinnati Milling Machine Co., Cimastra Div.	840
Claremont Pigment Dispersion Corp.	1309
Coating Products	504
Comet Industries	1308
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Cosmos Electronic Machine Corp.	135
Crystal-X Corp.	429
Cumberland Engineering Co.	1100
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Dake Corp.	1521
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Davis-Standard Div., Franklin Research & Development Corp.	1428
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Diamond Alkali Co., Plastics Div.	1606
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Dow Chemical Co.	933
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Eastman Chemical Products Inc., Plastics Div.	1105
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Farris Universal Machine Corp.	730
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Fellows Gear Shaper Co.	619
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Ferro Corp., Fiber Glass Div.	421
Fiberfil, Inc.	1518
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Firestone Plastics Co.	1009
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Foster Grant Co., Inc.	1434
Frank, J. P., Chemical & Plastic Corp.	1634
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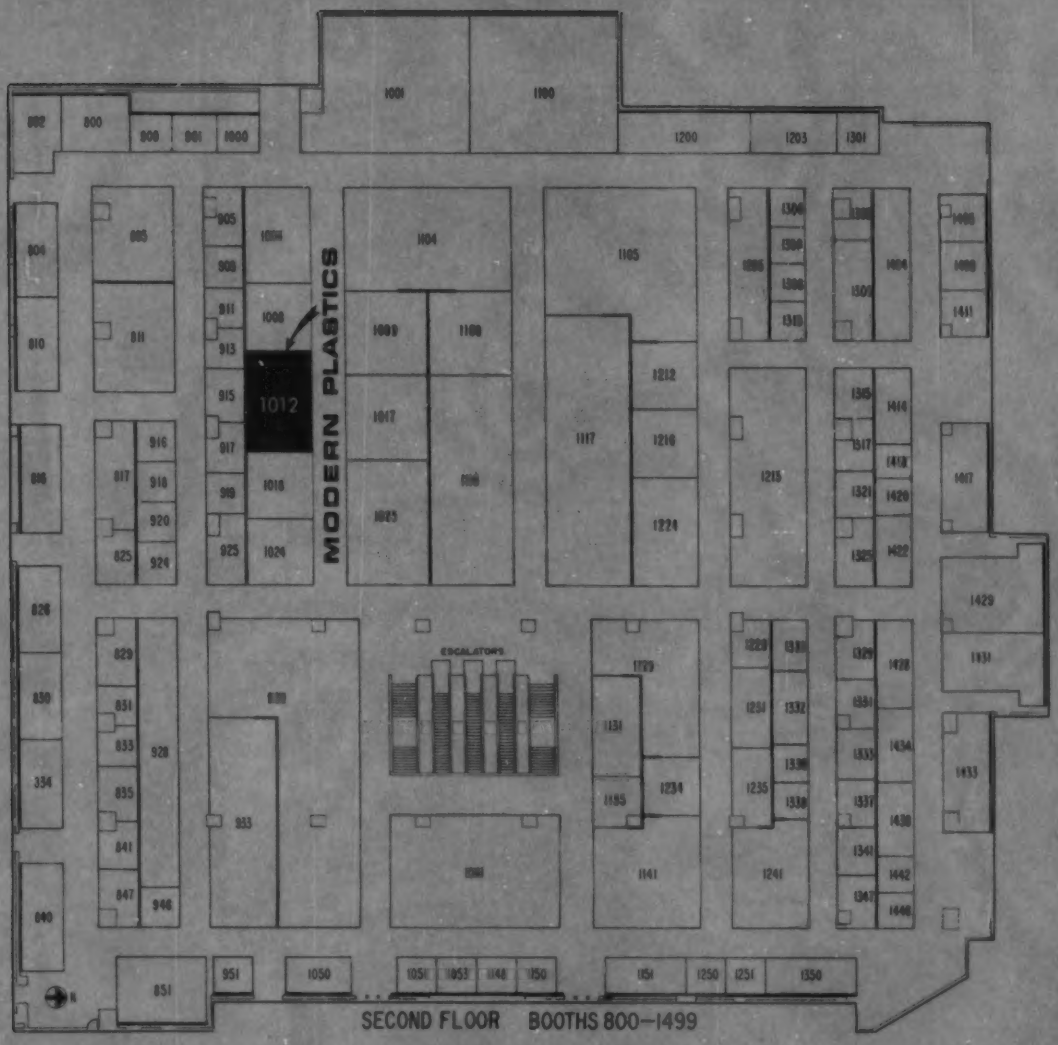

Exhibitor	Booth No.
General American Transportation Corp., Plastics Div.	1008
General Aniline & Film Corp. Dyestuff & Chemical Div.	1053
General Electric Co., Chemical & Metallurgical Div., Chemical Materials Dept.	1116
Georgia Kaolin Co.	1306
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Novamont Corp.	1241
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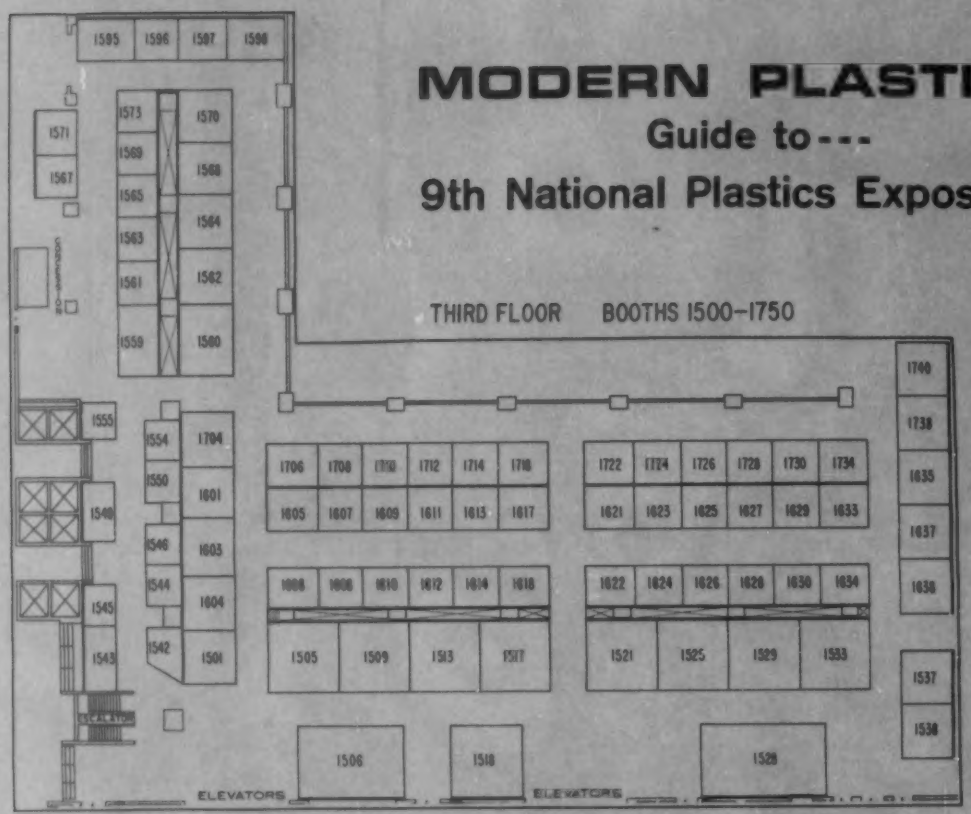
MODERN PLASTICS

Guide to---

9th National Plastics Exposition



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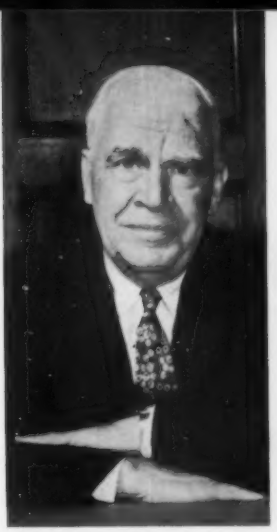


From the office of the Secretary . . .

GREETINGS TO THE INTERNATIONAL PLASTICS INDUSTRY

To the plastics industry in the United States: congratulations and best wishes for all success in your 9th Plastics Exposition and National Plastics Conference to be held in the Coliseum and Commodore Hotel in New York, June 5-9.

To the plastics industry overseas our best wishes for Europlastica 1961, which will run from June 16-25 in Ghent, Belgium, and for Interplas '61 at Olympia, London, from June 21 to July 1. To all visitors from the plastics industry abroad, welcome to our shores. We like to do business with you.

Of all industries built by mankind, the fabulous young plastics industry is one of the most international. When Wesley Hyatt, a New Jersey printer, invented cellulose nitrate in 1868, he founded an industry which has been responsible for improved standards of living all over the world. When Dr. Leo H. Baekeland—a Belgian chemist who became a naturalized American—invented phenolics in 1909, the plastics industry took its second great step forward.

From Germany, through the synthetic rubber program, came the styrene plastics. From the United States came the nylons. From France came cellophane. From Britain, polyethylene, the largest-volume plastic in the world today. From Switzerland and the U.S. came the epoxies. From the U.S. came the polyesters and polyacetals. From Germany, high-density polyolefins. From Italy, the polypropylenes.

Our American plastics industry has long been exporting money and both exporting and importing knowhow. Every major raw material maker has big investments all over the world. These investments, in conjunction with native capital, help assure advances in plastics technology that may be rapidly and profitably translated into increased standards of living. At processing level the same thing holds. A new machine or a new technique developed anywhere soon becomes a tool of plastics processors everywhere. This, of course, is a contributing factor to the growth of the world plastics industries.

There are three main avenues for the dissemination of technical and market information: plastics expositions, plastics conferences, and the plastics industrial and trade press.

The United States Department of Commerce, through the Commercial Standards Section of the Office of Technical Services, is proud to have shared in the development of plastics materials commercial standards which are recognized throughout the world. The S.P.I., through its Commercial Standards Committees and with technical assistance from the National Bureau of Standards, has established more commercial standards than any other industry association. This Department intends to strengthen the commercial standards operation so that stronger standards may be written for plastics. Top personnel from this Department participate in the plastics deliberations at the International Standards Organization.

Again, welcome! May your exposition and your conference be most fruitful.

Luther H Hodges

Greetings from S. P. I.

Russell C. Weigel
President

Every two and a half years the plastics industry pauses to take an appraising look at itself. This is one of those years—and the occasion of the 9th National Plastics Exposition and Conference offers several unique opportunities both to members of the plastics industry and to their customers. Certainly, this June 5-9 will give us in the industry the chance to see how far we have progressed. Our industry has reached the four-billion-dollar mark and still has an unlimited potential.

Perhaps more important is that people in the industry take this opportunity to study more carefully what has been accomplished in development of new and better materials and processes—and better products for American consumers and industry.

This year, the plastics industry is opening itself to a challenge and offering one at the same time through the Conference, to be held concurrently with the Exposition. Speakers at the Conference will be representatives from major industries that are our customers—building, transportation, communications, packaging, appliances, and defense. These authorities will not only state how they use plastics in their industries, but also will challenge the plastics industry to solve some of their existing problems.

The plastics industry will be on display this June—a situation that is both hazardous and advantageous. Every indication—the size of the Exposition, the calibre of the Conference speakers, anticipated attendance—suggests that the 9th N.P.E. will truly represent the industry and give us the opportunity to learn a great deal and, hopefully, to teach a great deal.—**End**

S. P. E.

Frank W. Reynolds
President

The rapid growth of the plastics industry in this and other countries is due in no small part to the application of one common denominator: the dedication and devotion by the technical, engineering, and scientific people affiliated with its many facets to the research, development, and production of materials acceptable to industry and consumer.

The result of these efforts has been to present to industry and consumer a versatility of product, akin to that of no other industry, the use of which has had a profound influence on the lives of millions of people here and abroad.

The most effective medium by which information on plastics has been and will continue to be disseminated is through National and International conferences, seminars, and exhibits. The publication of technical papers that appear in the many fine engineering and trade journals is, of course, an excellent way to convey information. But it has its drawbacks; you can't talk back to Article III, page 190, of any publication. It is the exchange or interchange of information between individuals and groups that adds up to education.

International plastics exhibitions and conferences, those next month and others throughout the year, afford the opportunity for the ambassadors of plastics engineers and scientists to get together to review new developments and plan for the bright future of the plastics industry.

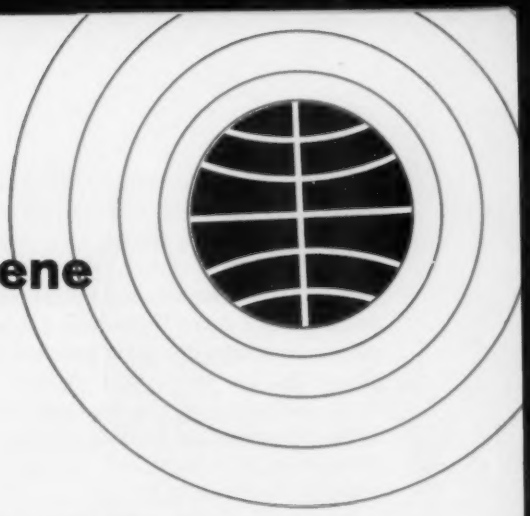
On behalf of the members of the Society of Plastics Engineers, I extend their hands across the sea in tribute to the International Plastics Conferences and Exhibitions with the sincere wish for their unqualified success.—**End**

PLASTICS--

the international scene

By Edward B. Seaton

Asst. Gen. Mgr., Overseas Div., Monsanto Chemical Co.



- Over-all, the United States will continue to dominate the picture. American influence will diminish as production facilities are installed abroad to meet the rapidly expanding industrial economies of the various world trading areas.

- Exports to the Common Market will definitely be more difficult as local manufacture takes over. Traditionally, European manufacturers build facilities to supply existing needs, but the pattern gradually is shifting to install excess capacity to meet future predicted market demands.

- The United Kingdom and "Outer 7" expect to supply their own plastics requirements, and facilities are being installed to accomplish this.

- The Asia-Pacific area finds Japan's growing economy offering possibilities for plastics export from America, but only of a temporary nature. Industry is strongly protected, and tax and other incentives are provided to encourage local production in Japan.

- In Latin America the trend also is towards local manufacture; currency restrictions and import quotas present real problems to the exporter.

Looking at the international scene, it is essential that we consider the United States' role both as a world producer and consumer. Often, when discussing world market developments, many of us tend to look only beyond our borders—overlooking, in the process, this country's dominant international position. Despite the fact the U. S. has only 6% of the world population, it accounts for 40% of the world market!

And while this article is directed towards the plastics scene abroad, it is well to keep in mind that on a global basis the tremendous American market represents most attractive prospects to foreign companies in terms of export of product, when output is more than can be consumed at home, or in export of capital and technology. Investment by foreign firms in the United States is over $16 billion, including foreign ownership of stock in United States corporations. The U. S. Dept. of Commerce shows imports by the U. S. in the past two decades have increased from $3.4 billion in 1939 to $9.7 billion in 1949, and then surged to about $23 billion in 1959.

As American industry has grown at home, U. S. businessmen have found that other lands also offer profit opportunities. The scope of the United States industrial activity abroad, measured by investment, has increased from $17.3 billion in 1953 to $29.7 billion in 1959, with further substantial additions being made in 1960. It is estimated that the American chemical industry is investing overseas at an annual rate exceeding $200 million, and that total investment abroad in chemicals and plastics by U. S. firms approaches $1.7 billion. Monsanto has expanded its gross assets in foreign areas from $72 million in 1953 to $290 million in 1960, an increase of 400 percent. Much of this expansion has involved production of plastic materials.

The major attraction for export or investment overseas by American plastics producers is the rate of industrial expansion there. Foreign growth,

in terms of real output, is often substantially higher than the 2.4% average yearly rate in the U.S.A. For example, Burma, Germany, and Japan all have an annual growth rate of real output well over 6%; Mexico is almost 6%; Italy, France, and Brazil are over 5%; India is 3.2 percent. Output of electricity, one good measure of industrial prosperity, has more than doubled in Europe since 1950. Use of plastics materials abroad in 1960, excluding the U.S.S.R., is expected to increase over 70% from 1957, while U. S. plastics output is projected to grow 40 percent.

In a nutshell, the world international plastics picture is this. Before World War II, Germany was the world's major plastics producer. By war's end, the United States had forged far ahead, and in 1952 America accounted for nearly three-quarters of the world's plastics production. Excluding the U.S.S.R., world plastics sales in 1959 were estimated to be almost 12 billion lb., up over 60% from 1955's 7.4 billion pounds. U. S. production of about 5.5 billion lb. in 1959 represented 45% of the world output. And world plastics production for 1960 of some 14 billion lb. may be equaled by the U. S. before 1970.

In export sales, the United States led the world in 1958 with over 570 million lb., followed by Germany with about 430 million pounds. If U. S. exports to dollar areas, primarily those to Canada, are excluded, German export sales were slightly more than those of the U. S. for 1958. And while total U. S. exports lead all other countries in volume, on a percentage basis, Germany and the U. K., in 1958, exported some 30% of their total plastics output, and Italy 25%, as compared with about 13% for the United States.

The five largest plastics which account for about one-half of the world's total plastic production are: the aminos, phenolics, polyvinyl chloride, polystyrene, and polyethylene. And of the five, the thermoplastic materials are increasing most rapidly and already represent about 35% of all plastics sales volume world-wide. It is to PVC, polystyrene, and polyethylene that I shall direct most attention in this discussion.

Edward B. Seaton

Mr. Seaton, who is Asst. Gen. Mgr. of the Overseas Div. of Monsanto Chemical Co., joined the firm in 1940. In 1950, he was in Japan and India studying their chemical industries, and in 1951, he was named European technical representative for the Research and Engineering Div. Based in Paris and Geneva, he spent three years in that capacity. He became director of development for the Overseas Div. in 1954; was named dir. of operations in March 1960. A graduate of Case Inst. of Tech., he assumed his present post in July 1960.

European Common Market

Let us look now specifically at the major world trading areas in terms of plastics potentials and production. First and foremost, the European Common Market—the "Inner 6"—much discussed the past several years, is expected to match the size of the current U. S. market in about 15 years, which will require a trebling of consumption in the area—a tremendous potential.

Sales of all plastics materials in the Common Market for 1959 of over 2.8 billion lb., about one-half of the U. S. sales volume, were up almost 26% from 1958, and are projected to grow a healthy 13% in 1960. Imports in 1958 were over 12%, with Germany being by far the major plastics importer and exporter. As might be expected, on a per-capita basis, Germany is the Common Market's leading consumer of total plastics materials. This year, consumption is estimated to approach 30 lb. per person, which modestly exceeds the estimated U. S. 1960 per-capita consumption of slightly over 27 pounds. France, on a per-capita basis, represents more than one-half Germany's consumption, and Italy somewhat more than one-third.

In thermoplastics, polyvinyl chloride is the oldest and largest volume material produced in the Common Market. Total output is soon expected to be approximately that of the U. S. Germany has production capacity of about 300 million lb. per year. France expects to increase production to 220 million lb. in 1961, which is more than a 40% increase over 1958, and Italy's aggressive expansion may well match French capacity by 1961. Markets and uses for PVC are similar to U. S. applications, though greater emphasis is placed on foam and rigid products. It is conceded that European technology in rigid PVC is superior to that in the U. S. Price competition in the Common Market is almost as strong as in Japan, and export of PVC from the U. S. offers little opportunity except for specialties.

Polystyrene consumption in the Common Market has continued to surpass forecasts. Germany is Continental Europe's largest producer by far, followed by France and Italy. This year, total Common Market consumption is estimated to be

about 26% of the estimated almost 1 billion lb. expected to be produced in the U.S.A.

Uses of polystyrene closely pattern those in the United States, though in Germany there is a tendency to injection mold the larger shapes, particularly in refrigerator inner-liner applications, rather than to thermoform them. The injection-molded product is said to be more suitable for European conditions because German refrigerators tend to be smaller than those that are sold in the United States. The largest German refrigerator is about 8 cu. feet.

The fastest growing thermoplastic of all in the Common Market is polyethylene. Estimated production of 675 million lb. in 1959 is expected to be more than 3.5 times the output in 1958. Of individual countries, the most recent rapid increase has been Italy, which appears destined for substantial over-capacity this year, since 1959 sales of about 35 million lb. are unlikely to grow to anything approaching the projected 300-million-lb. capacity in 1963. Germany is predicting capacity in 1964, for both high-pressure and low-pressure material, of over 500 million pounds.

In the Common Market, merchandise packaging using polyethylene is expected to increase most dramatically, and use in this application should more than double in the next five years. At the moment, the average polyethylene price in the Common Market is about 22¢ a pound. Predictions are that further price pressure will develop this year in Europe as a result of over-production there. Incidentally, polyethylene is exported to the world in larger quantities from the United States than any other plastic. In 1959 almost 300 million lb. were exported and this, coupled with more than 220 million lb. exported in 1958, accounts for almost 40% of the total plastic exports from the United States in those years.

The production of plastics in the Common Market is far more concentrated than in the United States. In Germany, splinter groups of the former I.G. Farben complex—Bayer, BASF, Hoechst, and Huels and their associated companies—account for over half of total plastics output. While it is more difficult to trace ownership of plastic manufacturing companies in France, because many of the largest firms form interlocked subsidiaries and affiliates, four of the major French producers—Pechiney, Rhone Poulenc, Saint Gobain, and Kuhlmann—account in one way or another for most of France's plastic output. Monsanto-Boussois is an exception, being the country's leading polystyrene manufacturer. In Italy, Montecatini accounts for almost 60% of all plastics production. Societa Edison, through joint ventures with Monsanto and Union Carbide, is Italy's second plastics producer and accounts for much of the market not filled by Montecatini.

European Free Trade Association

In the European Free Trade Association, or "Outer 7," composed of the United Kingdom, the Scandinavian countries, Switzerland, Austria, and Portugal, plastics production is dominated by the United Kingdom, and in the United Kingdom by far the largest producer is Imperial Chemical Industries Limited. Distillers ranks second, followed by subsidiaries of Monsanto and Union Carbide. Shell is rapidly expanding its operations.

I.C.I. is a major factor in polyvinyl chloride, making about two-thirds of the United Kingdom total output. Distillers, through association with Goodrich, is also an important manufacturer.

Following its lead as the original producer of high-pressure polyethylene more than 20 years ago, I.C.I. is still expanding production facilities beyond present estimated capacity of 220 million pounds. Subsidiaries of Union Carbide and Monsanto produce high-pressure polyethylene in the EFTA, and are located in the U. K., as is a Shell plant now under construction. Shell Chemicals Ltd., a Distillers associate, and I.C.I. all soon will be important in low-pressure PE. Construction of two PE plants in Scandinavia is set for this year.

In polystyrene, Monsanto is a major producer in the U. K., along with a Distillers associate and several smaller manufacturers. Modest polystyrene facilities also exist in Norway and Sweden.

It seems certain that the United Kingdom will continue to dominate plastics manufacturing activities in the EFTA. Well-entrenched U.K. manufacturers have traditionally exported to other nations making up the "Outer 7" group.

While there is much speculation on whether the "Outer 7" and "Inner 6" will be welded together, the political, supranational interests of the Common Market appear to be a major stumbling block to early acceptance of such a merger, by the U.K. particularly. Merging of these two major world marketing areas would further stimulate their already substantial industrial growth potentials by eliminating restrictions on free flow of goods and people. Plastics export to the area will be influenced by decisions concerning the level at which tariffs will be established. Tariffs may be lower than originally expected.

Asia-Pacific

Of the remaining major world areas, Asia-Pacific, Latin America, and Middle East-Africa, I intend to direct comment only to (To page 280)

REPORT from ENGLAND

By Finlay Wells

Vice-chairman, British Plastics Federation

Advances in acrylic . . . New applications aimed at construction market . . . Expanded styrene in cooling towers . . . Colored acrylic telephones . . . Rigid PVC finds outlets

On behalf of the members of the British Plastics Federation I extend a very hearty welcome to all United States visitors who will be visiting the 1961 Interplas Exhibition in London in June. On exhibition there they will see a wide range of materials, equipment, and products representative of the industry sketched but briefly here.

Materials

The British plastics industry continues to grow; the main emphasis is on established materials, *e.g.*, polyethylene (both high-pressure and low-pressure types), PVC, and polystyrene. Since the last International Plastics Exhibition in London in 1959, one manufacturer has started commercial production of isotactic polypropylene, with an annual capacity of 24,000,000 pounds. The Ziegler/Natta process is used under license from Montecatini, of Italy. The commercial production of vinylidene copolymers also started in the latter half of 1960.

Most of the expansion in British plastics raw materials has come from refining established polymers to produce special grades for particular processing methods. The availability of the fine powder form of acrylic molding material, for example, has led to a considerable expansion of markets both in extrusion and molding.

A range of water-soluble primers and resins for industrial finishes that are self-extinguishing and free from odor has also been developed.

On the thermosetting side there has been development in faster-curing urea powders and in polyester pre-mix molding compounds from which thick-section parts free of internal cracks and voids can be produced by conventional processes. Most of the latter material has gone into a wide range of applications for the electrical and allied engineering fields.

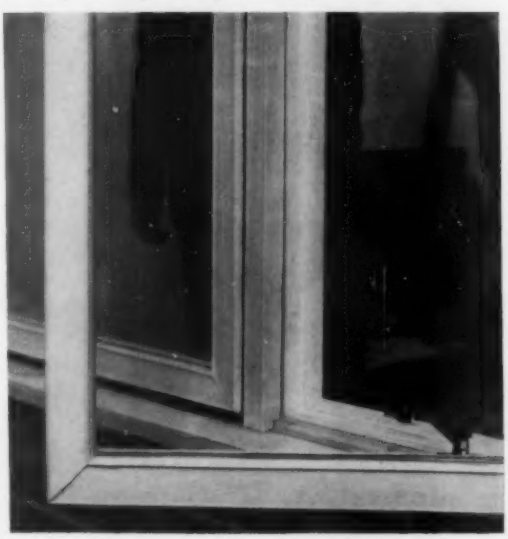
Epoxy resins, while still in the relatively early stage of development, are showing considerable promise in non-skid flooring and road surfaces; in solventless form they are used as surface coatings for marine and other applications where corrosion resistance is a problem.

For some years, polyethylene terephthalate film has been produced in Britain on a pilot plant basis, but at the beginning of 1961 a full scale plant started operation. Many uses have been established for this film, particularly in the electrical industry.

New applications

During the last two years attention has focused on the building industry as a potentially large consumer of finished plastics products. Baths, sinks, and drainers made from acrylic sheet have been in production in Britain for some time and quite recently a multiple wash-hand basin unit

WEATHER-RESISTANT window frames consist of rigid PVC extrusions over wood or metal. Locking strip of vinyl forms weatherproof seal for frames, while glass is gasketed by flexible PVC.

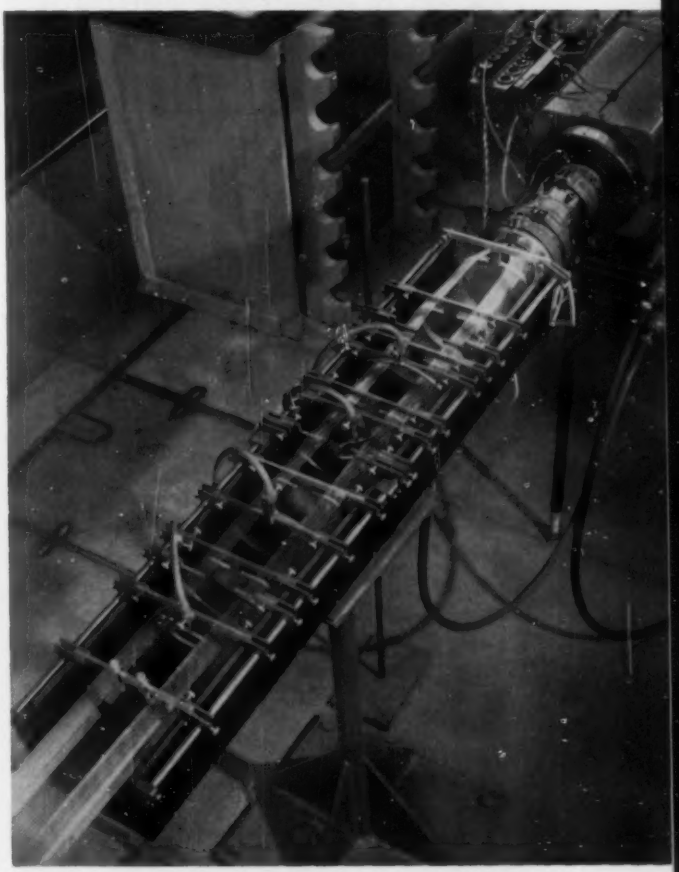


has been developed. Several of these basins can be installed as a single unit without joints, cracks, or grooves which can harbor dirt. Other forms of sanitary ware are also undergoing tests. Rigid PVC service pipes, gutters, and downspouts are now being widely used. An important factor in this development has been the rising cost of labor in Britain coupled with the fact that the lightweight PVC installations, being easier to handle, are competitive in cost with installed cast iron systems. Rigid PVC extrusions are being used for covering wood or metal for weather-resistant window frames (photo, p. 142). The extruded sections are attached to a wooden or metal frame and a specially designed PVC locking strip forms a weatherproof seal for the frame. The glass is held in place with a PVC extruded gasket.

Polyethylene (PE) continues to hold an important position in the houseware market—and moldings are getting bigger and bigger. As Britain becomes more packaging conscious, the amount of PE film used by this market continues to increase. Packaging of detergents in containers shows one interesting difference from the application as used in the United States. In Britain the consumer has developed a preference for flexible containers made from low-density PE that offer "squeeze-to-use" features. This development, largely one of fashion and taste, has been made possible by the fact that British producers of PE are able to offer a satisfactory low-density mate-

INEXPENSIVE PVC sandals are made by low-pressure injection molding. Note molded-in treads of sole and heel. Application raises possibility of making shoes with PVC soles, leather uppers.

ACRYLIC DIFFUSERS for fluorescent lamps are produced by method involving extruded and post-forming fixture. Material is extruded in circular shape, slit along top as it comes from die, then post-formed into final rectangular shape. Street lighting is becoming big market for diffusers.



TELEPHONE HOUSINGS are injection molded in color from acrylic material. Large-volume usage of the phones by the Post Office has given considerable boost to consumption of the resin.

Photos, I.C.I.

Photo, I.C.I.

POLYPROPYLENE linen hamper is first British domestic item in this material. It is strong, resists dampness, has hinged lid which doubles as seat.

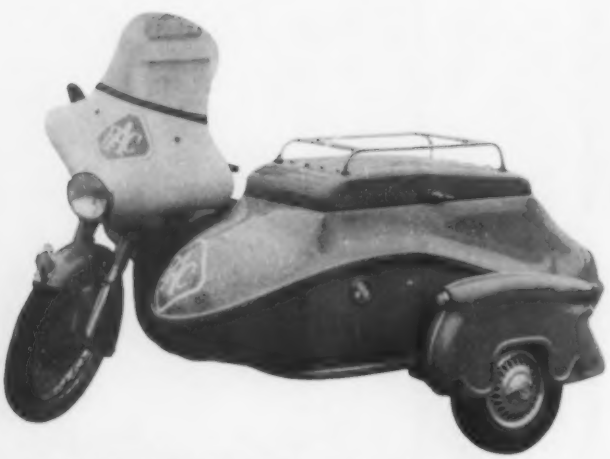
rial with the necessary good stress-crack resistance properties.

Boosting the use of acrylic in Britain, the British Post Office is now using substantial quantities of the material for their colored telephones. There has also been a considerable expansion in the use of extruded acrylics for lighting fixtures, particularly in conjunction with fluorescent lamps (photo, p. 143). Many different kinds of sections are made by postforming a circular tube which is slit as it comes out of the die. Visitors to the Interplas Exhibition should notice the widespread use of acrylic fittings in street lighting, both in the City of London and in the fashionable streets of the West End. Another interesting development is an injection-molded acrylic television tube implosion guard which is cemented to the tube face.

Improvements in the heat resistance of both basic and impact grades of polystyrene have also resulted in increased use of these materials. Improved temperature resistance and high purity have given polystyrene a substantial market in the packaging of many foodstuffs, such as jams and sauces. Among the larger moldings now made in polystyrene are refrigerator liners, that can be mass-produced yet controlled closely as to wall thickness.

Expanded polystyrene is making considerable headway as thermal insulation and is being used extensively in building projects. Another interesting application for this material is the use of an oil-resistant type in the manufacture of slats for cooling towers that work on the film cooling principle. This application offers considerable advantages from the standpoint of reduced weight and lower construction costs. It could be of particular interest for cooling towers, used in conjunction with air-conditioning equipment, that are located on the roofs of buildings.

It has been interesting to observe the impact of polypropylene on the **(To page 289)**



MOTORCYCLE SIDECAR demonstrates design flexibility of glass-reinforced polyester resin. Car is weather-resistant, requires minimum of maintenance.

Photo, Bakelite Ltd.

DURABLE CRASH HELMET features outer covering of specially compounded PVC film, which is vacuum formed directly over glass-fiber helmet shell. Colored film eliminates need for painting.

Photo, I.C.I.

REPORT on INDIA... and HONG KONG

Both rely on imported materials and low-cost labor. While India seeks to develop a resin-producing complex to supply domestic needs, Hong Kong is geared to export of plastics products

The plastics industries of India and Hong Kong are built on two identical factors: 1) their economic ties with Great Britain—India as a member of the British Commonwealth of Nations, Hong Kong as a Crown Colony—and 2) the availability of low-cost labor. As a result, much of the plastics imported by both areas comes from the United Kingdom or other parts of the Commonwealth. And much of this material is processed on hand-operated machinery.

But while their foundations may be the same, the plastics industries of India and Hong Kong are quite dissimilar in structure. India is an importer, processor, and potential materials producer for domestic consumption. Hong Kong is an importer of materials for processing into export products.

India developing resin production

While the Indian plastics industry has grown rapidly during the last decade, this growth has been dependent on imports of raw materials, processing equipment, and even molds. But the Indian government, recognizing in plastics an important avenue to increasing employment and a promising approach for raising living standards, has given plastics considerable attention under the third Five-Year Plan for economic development. Under the Plan, which is the blueprint for growth from 1961-1965, India seeks to develop her raw materials production facilities so that by the end of the period, these totals[1] will be domestically produced (quantities in tons):

Thermosets: phenol formaldehyde, 6000; urea and melamine formaldehyde, 4000; and polyesters, 12,000.

Thermoplastics: polyolefins, 25,000; polystyrene, 12,500; polyvinyl chloride, 12,500; acrylics and methyl acrylics, 3000; cellulosics, 5000; polyvinyl acetate (emulsion), 4000; nylon-6, 4000; epoxies and alkyds, 7000.

India also plans to increase production facili-

[1] Figures from an article by Dr. R. M. Thakkar, M.Sc., D.Phil., A.R.I.C., in **Plastics Progress in India.**

Photos, S.P.I.

MANUALLY OPERATED injection molding presses in operation in cottage industry plant in India. Mold has been left open to demonstrate this technique to visitors.

MOLD-MAKER turns out mold for head of male figure in cottage plant entirely by hand tooling and carving.

BUTTONS are made on hand-turning machines in Hong Kong factory. Machines were adapted to processing of plastic "pearl" buttons, having originally been designed for use on natural shell materials.

ties for modern processing equipment. By 1966 it expects to have turned out some 350 thermoforming and laminating presses, 350 extruders, and 800 injection machines.

It is also seeking to improve the training of Indian technical personnel and, through member Indian companies, hopes to draw on the facilities of the Plastics Institute of London and the Society of the Plastics Industry and the Society of Plastics Engineers in the United States for help in developing this program.

Hong Kong: Plastic Flowers Exports in 1958[a]

	H.K$
U.S	9,522,757
Canada	711,708
U.K.	255,070
Australia	164,077
South Africa	86,695
Malaya	33,388
Thailand	30,107
Middle & Near East	8,839
Br. West Indies	8,375
South Vietnam	7,295
U.S. Oceania	5,641
Taiwan	4,088
Philippines	4,021
Japan	3,700
Central America n.e.s.	3,627
Mauritius	2,682
Africa n.e.s.	2,665
Cambodia	2,273
New Zealand	1,605
Central African Fed.	1,534
Venezuela	1,513
Br. W. Africa n.e.s.	1,502
Laos	1,355
Nigeria	1,317
Br. Borneo	1,194
Macao	1,000
Fr. Equ. & W. Africa	580
Belgian Congo	575
Ceylon	200
TOTAL	**10,870,669**

[a]Source: Department of Commerce and Industry, Hong Kong.

Plastics: No. 2 Hong Kong export

In the last decade, plastics items processed in the Colony have become Hong Kong's second export earner. Biggest item of export since 1958 has been injection-molded flowers, of which more than 90% are exported to the U.S. (see table).

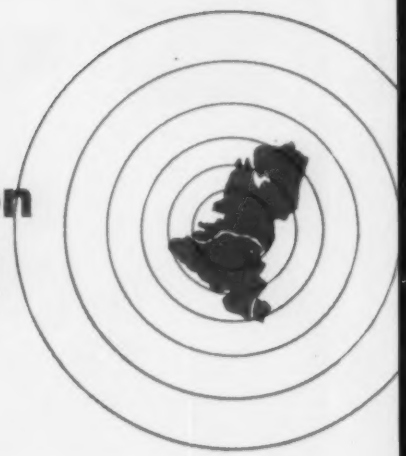
With the exception of a small quantity of phenolics, all raw materials are imported. Only a small percentage of the products processed from these raw materials are for local consumption; the rest are exported all over the world. In addition to plastic flowers, main items of export are buttons, vinyl rainwear, toys and toy components, housewares, and footwear.

Because of the economics of Commonwealth preference duties, the United Kingdom and Canada together provide more than half of Hong Kong's raw material imports. The United States, however, accounts for some 25 percent. This reliance on imported raw materials seems destined to continue indefinitely. The Colony, already overcrowded, has little room for large-scale chemical producing facilities. Nor is the political status of Hong Kong conducive to the type of long-term multi-million-dollar investments which are needed.

Hong Kong, however, is making strides in local production of processing equipment. Much of it is copied from imported machinery. Hand-tooled molds are often of excellent quality. In fact, some of them have been exported.

However, the continuing presence of low-cost labor has kept much of the industry relying on hand operation wherever feasible.—**End**

REPORT on BENELUX



The core of the European Common Market is Benelux, the original free trade area comprising Belgium, The Netherlands, and Luxemburg. Later were added West Germany, France, and Italy.

Two great Belgian chemists contributed mightily to the development of plastics all over the world. L. H. Baekeland was the inventor of phenolics, and Ernest Solvay was the inventor of an economical process of producing soda. Today Solvay and Cie is a huge chemical complex, dominating the scene in Belgium through its subsidiaries, and holding interests in Imperial Chemical Co. in England, Allied Chemical Corp. in the United States, as well as other companies all over the world.

Coal was historically the basic raw material for the Belgian chemical industry, but high cost of coal mining is bringing a gradual swing to petrochemicals. The discovery of oil and gas resources in the lowlands has brought a new plastics economy to Belgium.

While phenolics, ureas, polyesters, cellulosics, silicones, and acrylics are made in Belgium, that country has established a world-wide reputation for leadership in vinyls. In Belgium was established one of the first plants for quantity extrusion of rigid flat and corrugated PVC sheet.

Holland, like Belgium, based its original chemical development on coal, and a good part of Holland's chemical industry is fed by the state-owned coal mines, Staatsmijnen, which have been drastically modernized. At the same time that the Dutch East Indies gained independence, huge oil and gas reserves were discovered in the lowlands, and these now contribute as raw material sources for plastics. All the common plastics are made in Holland, and new facilities are being built for polypropylene and polyester fiber and film. Reinforced plastics molding is becoming big business, especially in the large boat field, where the Dutch excel.

LINEAR PE is injection molded for seat and back of Dutch chair. Units are made of individually molded slats which snap together without the need for fasteners.

Photo, Brillant Plastics, N. V.

One of the biggest producers in The Netherlands is Algemene Kunstzijde Unie (AKU) which produces caprolactam nylon from synthetic phenol. Royal Dutch Shell Co.'s subsidiaries produce epoxies and melamines. Biggest processor of plastics is Philips Electrochemical, which produces a complete line of phenolics and polyesters for its own purposes.

Several American interests are involved in the industry in Holland. These include Ferro Corp., Dow Chemical Co., Hercules Powder Co., U.S. Polymeric Chemicals Inc., Monsanto Chemical Co. Both Watson-Stillman Division of Farrel-Birmingham Inc. and Hydraulic Press Mfg. Co., Division of Koehring Co., have arranged for licensed manufacture of their machines in Holland for local use as well as for export throughout all of Europe.

In The Netherlands, at the Hague, is the Plastics Research Institute T.N.O. in Belgium, its counterpart is the Centre d'Etudes des Hauts Polymeres. Both of these organizations carry out fundamental research with government-industry financial support.—**End**

REPORT from WEST GERMANY

By Dr. Benedikt Rau

Chairman, West German Plastics Material Makers Assn.

High-budget research and development programs have pushed the German plastics industry to a growth rate well above that of the rest of the fast-growing German economy

A resin production of close to 1 million tons in 1960, representing a volume increase of 24% over 1959, again put the growth rate of the West German plastics industry well above the performance of German industry in general and the chemical industry as a whole in particular. Underscoring this growth was the amount of money, time, and effort spent on research into materials and processing technology. Described below are some of the more recent developments emanating from such research.

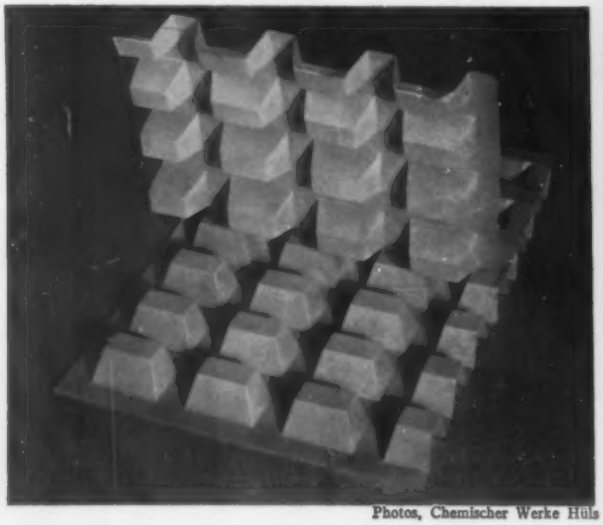
Materials developments

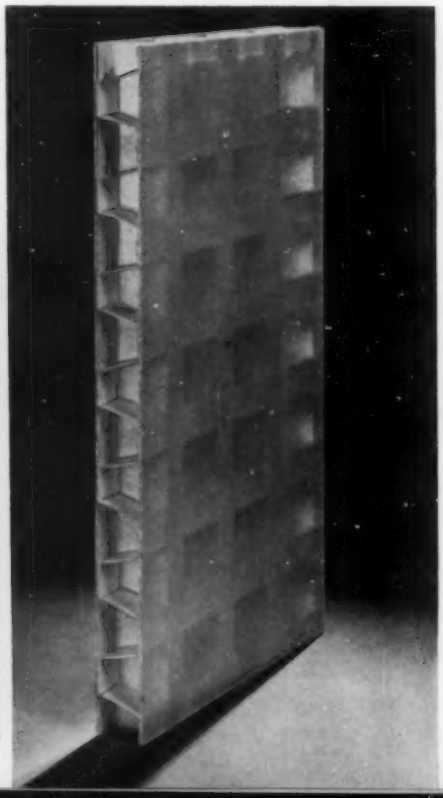
Polyvinyl chloride: Emphasis in PVC, still the most important thermoplastic in Germany, is on special modifications of the material aimed at expanding markets. One such modification involves blending rigid PVC with chlorinated polyethylene (which functions as plasticizer) to create a material characterized by high impact strength even at low temperatures (For reference, see MPI, April 1951, p. 94).

Applications for these blends include extruded sheets, pipes, contours, and shapes. Of particular interest in this connection was the recent appearance of corrugated sheeting made from the blend, which has found many uses in building construction where its strength, flame resistance, weathering resistance, and chemical resistance could be put to use.

Contributing to the growth of these applications has been the recent perfection of equipment

NEW DIMENSION in rigid vinyl is represented by unusual thermoformed rigid PVC. The material, in thickness of 40 to 60 mils, is formed in a modified egg-crate pattern. Two identical-formed sheets are then bonded in such a way that the raised squares interlock and form a "honeycomb" type structure (right). Faced with rigid vinyl sheeting to cover the depressions, this construction results in a strong panel for use in doors, partitions, and construction modules.





Photos, Chemischer Werke Hüls

INTRICATELY CONTOURED molded styrene foam serves as package for oil burner component, protects its delicate mechanism in shipment without necessity for any additional cushioning material.

to extrude rigid PVC sheet wider than 1 m. (3.28 ft.) through slotted dies. The problem that had to be overcome in this connection was the need for an extruder design that would eliminate stagnant areas in the barrel and nozzle where the material could hang-up and be subjected to excessive heat. Mechanical devices for the subsequent continuous longitudinal or transverse corrugation of the flat sheet were also developed.

An unusual construction of thermoformed rigid PVC sheeting has also attracted considerable interest in the building trades in Germany. In this construction, two sheets of rigid PVC, 40- to 60-mils thick, are thermoformed in a square egg-crate pattern (photos, left). Two identical formed sheets are then bonded back-to-back (so that the raised squares interlock) to produce a unique sandwich construction with what could be described as a "cellular" core. Excellent heat insulation characteristics and high flexural strength indicate a potential for the construction in prefabricated building panels and in automotive and aircraft design.

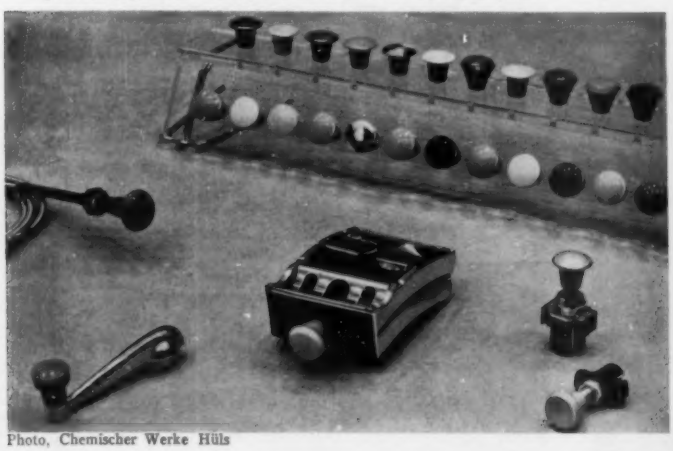
In PVC foams, a low-pressure process has been developed that produces a uniform closed-cell structure with greater elasticity than foams produced without pressure. Mass-produced molded parts made by the process have already found use as cushioning in automobiles.

Also new is a closed-cell rigid vinyl foam cast to specific density that can be surfaced with rigid vinyl sheet, reinforced plastic sheet, vinyl-metal laminates, etc., to produce such prefabricated parts as doors or building panels.

Polystyrene: High-impact types are coming more and more into prominence. There is particular interest in a new high-impact grade based on styrene and acrylonitrile, which contains an additional saturated plasticizing component that contributes excellent resistance to aging as well as to weathering.

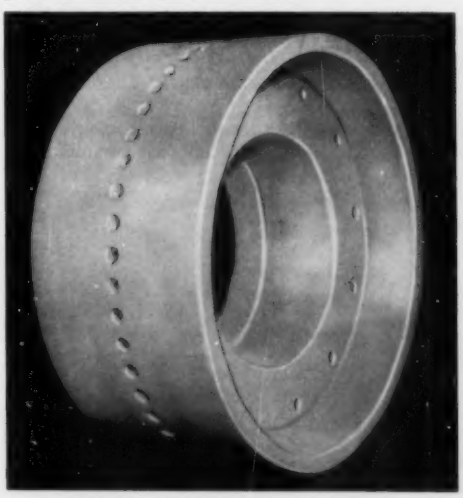
Foamed polystyrene is the most important of the rigid foams in use in Germany today (although available in weights of 15 to 200 kg./m.^{3}, (approx. 25 to 335 lb./cu. yd.) the bulk, approximately 80 to 90%, is sold in weights of 15

AUTOMOTIVE KNOBS made from plasticized vinyl foam produced by the low-pressure technique. Knobs, which come in range of colors to match with car decor, provide significant safety factor to interior of automobile.



Photo, Chemischer Werke Hüls

CONTROL HEAD for filter housing is produced from a high-molecular-weight grade of low-pressure PE. Because of its high viscosity, material is compression molded, then machined.



Photo, Farbwerke Hoechst

Photos, Farbenfabriken Bayer

REDUCTION VALVES and valve housings are made from polycarbonate resin. Good corrosion resistance, even at elevated temperatures, makes the material suitable for this application.

to 20 kg./m.^{3}). In addition to standard types, self-extinguishing and gasoline- and oil-resistant grades are also available. Main application areas are building and refrigeration.

Polyethylene: A low-pressure PE with a very high degree of polymerization (molecular weight is over 1 million) and produced by the Ziegler process is one of the more unusual developments emanating from Germany. The material has an extremely high-impact and notched-impact strength, even at temperatures far below —100° C., and a high degree of resistance to corrosion. Applications already taking advantage of the material's properties include parts for the textile industry that are subjected to high impact, gaskets and joints, packings, skids, orthopedic applications, and corrosion-resistant equipment (photo, p. 149). As a result of the material's high melt viscosity, processing is possible only through compression molding of blocks and slabs, from which the finished products are then machined.

Acrylic: Working on copolymers in this area, German research has developed an acrylic crystal for waterproof watches. Because of its outstanding dimensional stability under loads at temperatures up to 130° C., the acrylic remains tight under a water pressure of 3 m., even after repeated heating to 65° C.

Impact-resistant copolymers of acrylonitrile and methyl methacrylate have recently been put to use as TV set implosion shields that are only 4 mm. (1.37 in.) thick.

Advances have also been made in the technology of bonding acrylic parts. Heretofore a three-component system was necessary; now single- and two-component bonding cements have been developed. In this connection, a single-component cement which polymerizes under sunlight or under certain "cold-light" frequencies has recently been perfected.

Polyamides: New nylon compositions for injection molding have been developed which can be processed under normal operating conditions to obtain a substantially homogeneous, fine crystalline structure for stress-free parts.

A unique method of polymerization has made it possible to produce a high-molecular-weight nylon for both stock shapes and finished moldings. The material is characterized by toughness and resistance to high temperatures. It is used either for large parts or for short runs for which injection molding is not economical.

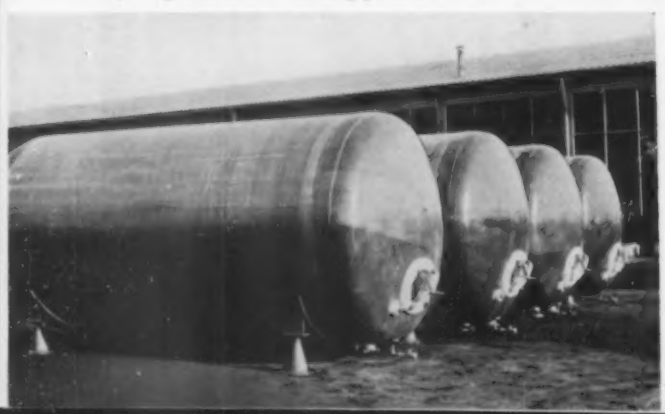
A PE film coated on both sides with nylon and characterized by high impermeability to odor, resistance to moisture, and lack of sensitivity to fats is another of the more recent West German developments.

Polycarbonates: Injection-molded polycarbonates continue to find application in the industrial field (photo, above) and more recently in the design of consumer products requiring higher resistance to heat and greater impact strengths. A new use is expected to develop as a result of refinements in techniques for coating metal with the material. The metal is pre-heated to over 100° C. before application of the coating.

Unsaturated polyesters: These resins have taken on added importance in the Federal Republic not only for glass-reinforced products but for varnish and enamel uses. Buttons have also developed into an extremely important volume market for polyester resins.

In the area of fibrous glass-reinforced polyesters, attention has focused recently on the potential for the material in industrial containers (photo, left). To produce these containers, filament winding has developed into an important process. Resin-impregnated fibrous glass rovings are wound in a criss-cross pattern on a rotating cylindrical mold and cured. After removal from the mold the containers are **(To page 292)**

LARGE CONTAINERS for service in corrosive environments are produced of glass-reinforced unsaturated polyester, using the filament-winding process.



DURABLE polyvinyl chloride chair seat and back is featured in contemporary design. PVC part is injection molded in one piece.

By Nicolas R. Palacios

Argentine Chamber of the Plastics Industry

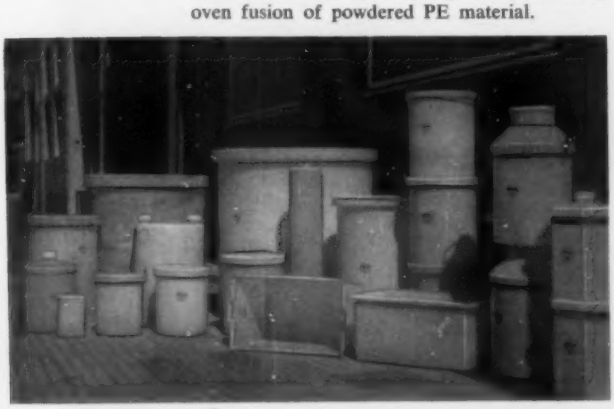
REPORT from ARGENTINA

In 1960, when plants for the production of PVC and melamine molding compounds went on stream, the Argentine plastics industry had completed a cycle of development that had started in 1940 with the manufacture of phenolic resins. In the intervening years, installations for the production of urea molding compounds, cellulose acetate, various grades of polystyrene (based on imported monomer), certain polyamides, and polyesters came into being. Now with plans in the works for the construction within the next two years of two major petrochemical facilities that will produce polyethylene, styrene, butadiene, and a number of other plastics resins, the country can proudly boast of a large and aggressive plastics industry.

Processing facilities have similarly been refined and expanded over the years to include virtually all known techniques. Compression presses up to 4000-ton capacity, injection machines up to 300-oz. capacity, and extruders up to 6 in. in size are currently in use.

Employing some 15,000 workers, the Argentine plastics industry has a combined evaluation of approximately 6 billion pesos, or roughly the equivalent of $73,175,000.

POLYETHYLENE tanks and canisters in different types and sizes are a recent application. Items are made by Engel process, involving oven fusion of powdered PE material.



Application developments

New to the country is the recent adaptation of the "Engel process" for making large PE containers and tanks up to 1300 gal. in capacity.

Another rapidly developing market has been found in the production of disposable low-cost containers and tumblers for consumer packaging.

Plastics housewares, which have always been a big market in Argentina, have seen the impact of high-density polyethylene and impact-grade styrenes in the form of upgraded products that have expanded the market even further.

Supported and unsupported vinyl fabrics have become so important that they have virtually supplanted leather—a traditional Argentine material—in the manufacture of such consumer products as handbags; they are now being adapted in increasing quantities to the upholstery and rainwear markets.

The building industry has been slow to accept plastics but it is noticeable that advances are now starting to be made in the use of vinyl wall tile, venetian blinds, flooring, polyethylene cold-water piping, and corrugated sheeting.

The automotive industry already includes among its list of plastics products: steering wheels, lighting fixtures, bumper parts, door handles, and films and extruded profiles for upholstery and trimming.

The refrigerator industry is concentrating on large-size moldings, *e.g.*, complete refrigerator interior cabinets, and is also making considerable use of molded or thermoformed plastics crispers.

Boat hulls and furniture molded of reinforced plastics and car safety locks molded of nylon are among the newer Argentine products.—**End**

REPORT from ITALY

By Dr. Sergio Compostella

Montecatini Soc. Gen., Milan, Italy

As in other European countries, much development work has been underway recently in specific areas of the Italian plastics industry. Most significant are the following: 1) new injection molding equipment; 2) progress in the development and application of polypropylene and other polyolefins; 3) production of ABS copolymers, methyl methacrylate, and polyester films within the last year.

After a concerted effort to develop injection molding machines to satisfactorily handle the high-molecular-weight materials which have a high viscosity in the fluid state, equipment designers recently introduced two new machines that are a departure from those in common use throughout the industry. One has a screw-plunger pre-plasticating unit in which the screw acts as a piston. In the second unit, the screw is a preplasticator feeding the injection chamber which has a conventional piston. These two units have met with such success that there is now a definite trend to convert, at a moderate cost, old conventional equipment to these more efficient designs. Molders report the following advantages: 1) easier molding of high-molecular-weight, high-viscosity materials; 2) shorter molding cycles, shorter time in cylinder, less degradation; 3) complete homogenization of material with perfect dry coloring; 4) capacity of machine

Polypropylene applications extend to wide field. . .

APPLIANCES: Polypropylene motor housing of electric blender provides high strength and heat resistance for long service life, as well as affording the lustrous surface gloss for greater merchandising appeal.

HOUSEWARES: A molded lamp housing makes use of polypropylene's high strength-to-weight ratio. The shade is virtually unbreakable and is not affected by the bulb heat.

FURNITURE: Durability, light weight, and stain-resistant qualities of polypropylene make material a good choice in furniture, such as seats and backs of these contemporary chairs.

nearly doubled. Last year one Italian manufacturer built a 25-lb. capacity machine with a pre-plasticator unit that is being successfully used for molding refrigerator cells. He is building two additional units and has plans underway for a 45-lb. machine.

Much development work has been going on with rigid PVC. Injection-molded applications using these new techniques include large fittings and valves for industrial pipes, sewage disposal, building construction, irrigation, etc. Applications of PVC using extrusion techniques include venetian blind slats, window frames and doors, and shapes for surfacing building exteriors. A new item is translucent PVC sheeting, both flat and corrugated, for interior dividers and outdoor applications. The penthouse of one new building in Milan has been covered with this type of extruded sheet.

Foamed vinyl is now being used in a number of cushioning and structural applications. Road dividers molded of vinyl foam are in great demand because of the vast road building program now underway in Italy. The cushioning characteristics of this material decrease the amount of vehicle damage and passenger injury.

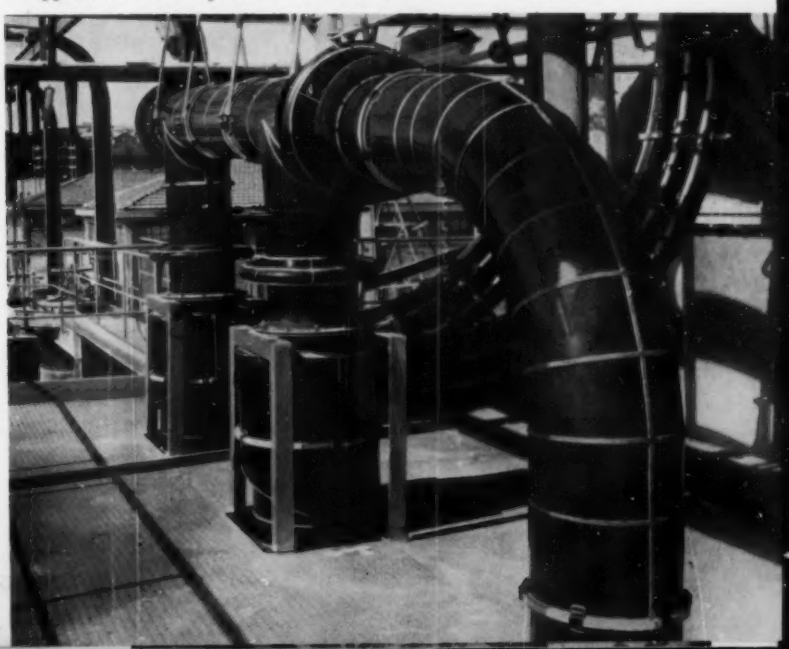
Progress of polyolefins—both in technology and application—has been outstanding. Most application activities have centered on polypropylene, which Italy introduced to the world. Refinements in formulation have been aimed at providing a complete range of melt indexes and molecular weights in polypropylene to meet any given end-use requirement. Cooperative efforts between producers, fabricators, and equipment designers have made it possible to both accelerate and expand the use of polypropylene.

Polypropylene is now being used in many areas as a replacement for wood, other plastics, and even metal, in both consumer and industrial goods. In industrial parts where physical and mechanical properties are of prime importance, high-molecular-weight materials have proved most desirable. Much success has been reported with these materials for use in pipes for transporting hot liquid chemicals. Polypropylene pipes for use under pressure are now being evaluated. In molding small objects, or those which do not have any particular mechanical requirements, lower-viscosity polypropylene is used.

To date, the major fields of polypropylene application are: automotive and housewares. In the automotive field, PP glove compartments, sun visors, brake fluid containers, distributor caps, fan housings and blades are current applications. In the last named product, polypropylene has shown important cost savings over metal fans. Regardless of the material, these fans require perfect balance. While a high percentage of the metal fans require individual balancing, with polypropylene this characteristic can be designed into the mold. Motor scooters and bicycles, which represent a substantial market in Italy, also have many PP parts such as shock **(To page 299)**

AUTOMOTIVE: Polypropylene engine fan is molded in single shot, resulting in correctly-positioned blades of uniform weight. Polypropylene part replaces metal fan, which saves production costs by eliminating the assembling of metal parts.

INDUSTRIAL: Chemical plant ducting for hot gas is welded from polypropylene sheets. Italian industry also uses extruded polypropylene pipe and tubing in a number of applications where pressure is not involved.



REPORT from FRANCE

By Jacques Duflos

Director, Fibrous Glass Technical Society

Typifying the strides being made overseas in the area of reinforced plastics is this report on the advanced work now going on in France

From the reinforcement standpoint, a good deal of interest has been expressed in the use of silica-fiber fabrics. These fabrics, with a composition of 99.99% SiO_2, have all the properties of molten pure silica. As there is no alkaline flux present, they are extremely resistant to high temperatures and can be used indefinitely without aging up to 1100° C. Service temperatures can even be increased to 1500° C. without any danger of the threads sticking together. Coefficient of expansion is only one-sixth that of fibrous glass and remains approximately constant from 0 to 1000° C. The silica fabrics are excellent insulators, particularly for high frequencies, and have good electrical properties. Chemical resistance, even in the presence of boiling concentrated acids, halogens, or stable oxygen-containing metallic salts, is considered to be excellent.

Applications include reinforcement for plastics intended to be subjected to extreme temperatures during short or prolonged periods of time; heat or electric insulators, particularly where low-voltage insulation at very high temperatures is required; and filtration media for fluids being processed at high temperatures.

Prepregs in France

For the more widely-used fibrous glass reinforcement, recent attention has focused on the use of the glass laid up in parallel layers that avoid the weak spots resulting from the interlacings in a woven fabric. This technique is finding increasing use in the aircraft industry. In order to meet the requirements of unidirectional materials with high-strength characteristics, filament-winding techniques with impregnated glass threads are assuming importance. Products being made in this way in France today are achieving tensile strengths of more than 120 kg/mm² (264 lb./mm²). Pre-impregnation of the fibers assures uniformity in the finished product, even in mass production, and tensioning of the filament-wound layers can be closely controlled.

Among the promising new materials now being

HEAT-REPELLING WALLS of desert dwelling consist of two RP layers cored with rigid cellular PVC. Unit rests on RP skis.

ANOTHER DWELLING, designed for Greenland, has RP wall panels with PVC foam core, combines high strength with ease of dismantling.

SANDWICH PANELS of polyester sheets framed by aluminum strips contribute lightness and translucency (about 30%) to building facade, help reduce glazing area and heating costs. French architects are showing keen interest in such panels.

researched in France are polyester pre-impregnated glass fibers that may cure in a matter of seconds. According to preliminary evaluation reports, these materials may be capable of being stamped or swaged—at mass-production speeds —into products for a variety of uses in the automotive industry.

Reinforced plastics applications

French architects have shown an enthusiasm for the use of reinforced plastics for all types of building construction—particularly for easy-to-ship, easy-to-assemble prefabricated translucent building panels.

Only recently a new building (photo above) was erected in Paris in which the non-supporting facade walls consisted of translucent reinforced plastics sandwich panels. The translucency of the panels, approximately 30%, is sufficient to reduce the glazing requirements in the building—and a consequent reduction in heating requirements. Mechanical strength of the panels is also high, regardless of the direction in which the force is exerted on them.

Another of the new RP building applications developed in France was an igloo-type structure (photo, left) large enough to house six people and to serve both as a dwelling and observatory—yet easy to erect or knock down. Inside diameter of the igloo is 6.5 m. (about 20 ft.), the height is 5.8 meters (about 18 ft.). Since this particular structure is intended to be buried in Greenland under a mass of snow and ice, the choice of reinforced plastics was particularly ideal in providing maximum mechanical strength and insulation characteristics with a minimum in weight and wall volume.

The prefabricated panels that make up the igloo consist of a core of cellular rigid PVC, 50 mm. thick (about 2 in.), with a polyester-glass facing, 3 mm. (0.012 in.) thick. The panels are edged on the inside with polyester-glass ribbing that permits easy assembly with nails or bolts.

The same type of panels, using stratified glass construction for the skins, go into a cabin (see photo, far left) for use in the Sahara. The entire unit, which can house from 2 to 4 persons, rests on two skis also of stratified glass/polyester resin. The weight of the cabin, complete with equipment, is 2 tons. Because of RP's integral coloring, painting is unnecessary. The RP structure resists rust, is self-extinguishing, water-tight, shock-resistant, and abrasion-resistant.

In aircraft, almost a ton of stratified glass/polyester resin is used in the construction of one plane, the Caravelle. Applications in the plane include: dorsal edge on the fusilage where the high-frequency antenna is housed; housings for electric connections; low-pressure air ducts; decorative panels; baggage compartment floors (sandwich construction); radomes; window frames; and baggage racks.

As in other countries, reinforced plastics are also playing an important role in France in the design of rockets and missiles. Nose cones now being tested in the Sahara are based on phenolic resins reinforced with silica fibers and treated asbestos or glass. These materials are also used for nozzles, where their resistance to mechanical stress at high temperatures is so important.—**End**

REPORT from JAPAN

By Shugo Miyamoto

Editor-in-chief, Institute of Polymer Industry Inc.

Vinyl is still backbone of industry . . . Government has okayed commercial production of polypropylene . . . Japanese-developed fluorine resins are coming on stream . . . processing machinery design is keeping pace with industry needs

Vinyl resins, with emphasis on the vinyl chlorides and vinyl acetates, have been and still are the backbone of Japan's plastics industry. However, several of the newer resins have started to make an appearance.

Polystyrene and polyethylene, both high-density and low-density types, have already come on stream. After much litigation, the Japanese government has finally approved the production of polypropylene by Mitsui Chemical Co., Mitsubishi Petrochemical Co., and Sumitomo Chemical Co.—all using Montecatini's technology—and by Shin Nippon Chisso Hiryo K.K. using AviSun technology. A polycarbonate resin was independently developed by Teijin Chemical Co., which is currently making plans to go into production with it. Polyurethanes are being produced under license from General Tire & Rubber Co., and several manufacturers are currently negotiating with Bayer in Germany and with Du Pont to import their urethane technology. Production of epoxy resins, also based on technology from abroad, is similarly being contemplated.

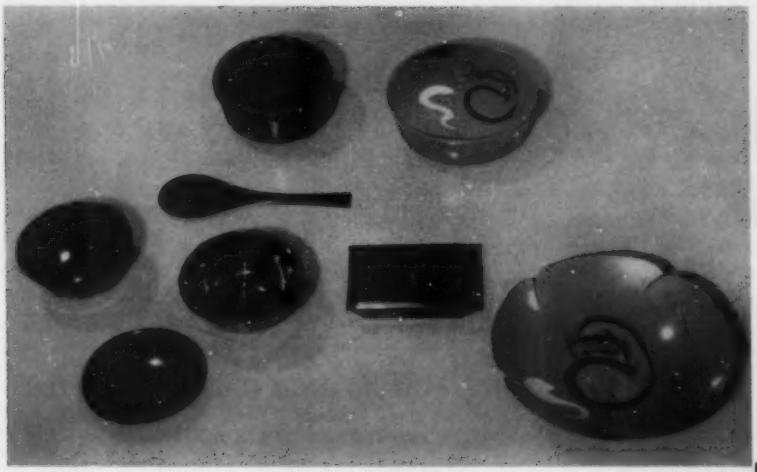
FIBROUS GLASS-REINFORCED polyester with mineral fillers is used for Buddhist statue. Statuary is made in plaster molds taken from bronze originals.

Research and development

While most of these production plans are based on the importation of foreign technology, native industry is making some important strides on its own. From companies such as Kureha Chemical Co., for example, have come techniques for making unplasticized polyvinyl chloride products flexible by the use of special copolymers or by polymerizing the basic polymer at lower temperatures. Matsushita Electrical Industry has started production of xylene resins based on their own studies; Maruzen Oil Co. has developed a new ester resin made from xylene; and Osaka Metal Co. has filed a patent on its own technology for vinyl fluoride and vinylidene fluoride resins.

In university laboratories, polyformaldehyde is under study, as is polyketone, which is manufactured by synthesizing ethylene and carbon monoxide with gamma rays.

Copolymers and alloys are also looked on as a



TRADITIONAL tableware is molded of urea resin. Motif on two bowls at right is added by molding resin-impregnated paper containing picture over initial shot.

POPULAR "WINKY" doll is made from black vinyl sheet material. Inflated doll clings to many objects, has patented "closing" eye, hence name given to product.

new frontier for the Japanese plastics industry. Now that butadiene has been made available in the country, several companies are planning to produce acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-butadiene copolymers. Methacrylate-styrene copolymers are also being watched with interest.

Advances in processing

The development of new and better plastics processing machinery is a major program in the plastics industry in Japan. Recently, technical know-how was imported by the Shibaura Machinery Co. from the Battenfeld Co. in Germany, involving the design and manufacture of completely mechanical injection machines, instead of the conventional hydraulic power system units. Because of the increased use of rigid vinyl in Japan, there has been emphasis on the development of machinery to handle this rather difficult material. Important also is the increasing use of reciprocating-screw injection machines.

There is a twin trend in Japan toward the development of injection machines to handle thermosets and compression presses to handle thermoplastics. A rotary compression molding machine was awarded the prize of the Director General of the Scientific and Technological Bureau for its efficiency in thermoset molding.

Another indication of progress in machine design is a new extruder with interchangeable heaters which can be switched to suit the particular processing temperature requirements of different materials.

Applications in Japan

The production of rigid vinyl pipe and sheet is noticeably increasing—and demand is rising to meet it. Most recently, the Telegraph and Telephone Corp. of Japan ordered 2000 telephone parts molded of rigid vinyl and it is hoped that this will establish that material in similar uses.

Vinyl, as competition for leather, and nylon fabrics are also steadily on the increase in the clothing and upholstery trades. A breathable cellular vinyl has attracted the attention of several clothing manufacturers; similarly, urethane foam has come into use as a lining for knit and woven fabrics for winter clothes, and even is used as lining by one manufacturer of swim suits.

Plastics, either by themselves or in combination with aluminum sheet and with concrete, are also making a mark in lightweight building construction.

Like other countries, Japan has also had its share of fads and gimmicks that have accounted for considerable consumption of plastics. One such fad was the very popular "Winky" doll fabricated of black vinyl sheet.—**End**

REPORT on the U.S.S.R.

By William T. Cruse*

Executive vice-president, SPI

The Soviet plastics industry is geared primarily for production of industrial equipment, but a new economic policy is spurring research, development, and manufacture for consumer use

The plastics industry of the Soviet Union has been set up to produce industrial products and not consumer's goods. Following the 1917 revolution, the communists adopted a policy which concentrated on building basic industries. The Soviet plastics industry has been developed in conformance with this policy, with the result that the U.S.S.R. has a well-established thermosetting plastics industry replete with facilities for manufacturing phenolic and urea molding compounds and several large compression molding plants, geographically well-distributed. In these plants are molded all types of industrially essential molded plastics. In the thermoplastics family, materials such as polystyrene, cellulosic, and vinyl are produced. These materials are mostly injection molded into consumer's goods. Compared to the production rates for industrial goods, however, they are relatively unimportant.

Cellulose nitrate is still made on a big scale. A substantial percentage of the production of one plant is devoted to making blown dolls of this material, an application which for safety reasons has been abandoned elsewhere.

Plan more plastics for consumers

The production of plastics consumer goods will be increased substantially during the next 7 years. Premier Khrushchev announced to the Central Committee of the Communist Party of the Soviet Union in May of 1958 that his government planned to build or construct in the current 7-year period, 1958 to 1965, a total of 257 chemical and related plants to increase the production of plastics eightfold; production of synthetic fibers will be increased 4.6 times, and synthetic rubber, 3.4 times. The Communist Party has long promised the people of the U.S.S.R. a higher standard of living with more consumer goods. In constructing these 257 plants it is apparently the government's intention to fulfill this homefront promise. The country's economic planners may now feel that the nation's plastics plant is adequate to take care of basic requirements.

The molding factories of the U.S.S.R. are predominantly equipped to do compression molding. Molding presses are of conventional design and sturdily constructed. Equipment ranges in size averaging from 5 to 200 tons. Radio frequency preheating is widely used. There has been no widespread drive to automate molding operations.

Compared with compression molding, other operations are relatively limited. Most injection molding is devoted to making consumer's items such as housewares and toys. Extrusion is largely devoted to turning out film and monofilament intended for electronic or related application. Intensified efforts are being made to inaugurate the production of polyethylene which may now be, or soon will come, on stream; volume extrusion of film should then follow. Such reinforced plastics as are produced in the U.S.S.R. are to date on a pilot-plant scale. No doubt the major part of their reinforced plastics industry is devoted to the country's space exploration program. In laminating, the emphasis is on manufacturing laminated sheets for electrical insulation and for such articles as steel mill bearings, truck brake shoes, and gear blanks. They are also producing refrigerator and automobile door liners.

Wide range of materials produced

Practically all commercially produced plastics materials are made in the U.S.S.R, including phenolic and other tar acid resins, epoxy and alkyd resins, silicone, urea and melamine resins, nylon

*Mr. Cruse was a member of the U. S. Plastics Delegation which visited the U.S.S.R. in 1958. The information contained in this article is based on his observations there and from discussions with informed persons who have since traveled in the country.

6 and 6/6, fluorocarbons, and most of the thermoplastics with the exception—for some inexplicable reason—of polyethylene. In the newer chemical factories, production systems are comparable to those of the U.S. Wherever production is of a standard commodity which has been in use for a number of years, the processes, procedures, and the equipment are about equal to ours. The technical competence of most of the personnel is high. One of the glaring voids, of course, is the absence of sales departments. With no selling to be done, no sales personnel are required. All production quotas are fixed by regional economic planning boards.

Factory personnel, at the management level and in the labor department, are dedicated workers. They are inspired by their desire to see their nation progress.

It has been remarked on occasion that the U.S.S.R. plastics factories are equipped with American or German machinery. This isn't so. Here and there there may be one or two non-Russian pieces of equipment, but on the whole all the chemical and molding equipment is of U.S.S.R. origin. Neither is it a fact that a large percentage of the research scientists are German. It is interesting to note that no German researcher was encountered in the five laboratories visited.

Western progress studied closely

The Russians follow closely technological developments going forward throughout the world. Under the auspices of the Academy of Science, an abstracting service is maintained. Set up in 1953, it subscribes to more than 8000 periodicals from 80 countries, including 1400 of the 1800 scientific journals published in the U.S.A. Its aim is to make any material of interest or value on a scientific or medical subject—published anywhere in the world—available in Russian within a few months after its appearance—abstracted, translated, and published. It can be said that no other government or private institution in the world maintains a translating and publishing enterprise of such magnitude.

In following the scientific literature of the world, the Soviets, whenever they encounter a new material, a new process, or a new application, can freely adopt it. They do so since their government does not recognize patent rights. Considering the vast amount of research that is going forward in Russia it behooves the researchers of the free world to follow the Soviet technical literature to learn of the developments which are being made there. Since patents are not a consideration, anyone in the West is at liberty to use materials and manufacturing or processing techniques developed by the Soviet scientists.

The overall impression of research in the U.S.S.R. is that it is strong and reasonably well conceived. They have many research workers who are well informed in plastics and who were trained in the U.S.S.R. It is doubtful if the total Soviet research effort in plastics exceeds the total effort in this field in the U.S.A. It is not their numbers but their eagerness and dedication to research that must be respected. Education, particularly in science, is their religion of faith and inspiration. The Scientific Research Institute of Polymerizing Plastics at Leningrad is one of several reporting to the Ministry of Chemistry on high-polymer research. The staff of the Institute numbers 1100. Of this number, 500 have the equivalent of a doctorate degree. The institute is concerned solely with the development of plastics polymers. The laboratory is departmentalized; representative departments include a physical testing laboratory, a styrene copolymer laboratory, a PE laboratory, a vinyl polymer laboratory, a fluorinated polymer laboratory, etc.

The research which is being conducted in chemicals and plastics is impressive. With an established basic plastics industry, with more materials-producing and processing facilities under construction, supported by a well-organized research establishment, with one-third of the world's land area occupied by 200,000,000 people anxious to enjoy more creature comforts as a market, with an inspired devotion to work dedicated to progress, the plastics industry of the U.S.S.R. is destined to go forward.—**End**

IMPELLER BLADES and shaft for hydroelectric turbine are molded of phenolic. Almost all plastics production in the U.S.S.R. is either heavy industry or for the nation's space program.

COLORFUL light diffuser shade is formed from acrylic sheet. Product is typical of Finnish work in modern lighting fixtures, using design flexibility inherent in thermoplastic sheet.

By Jorma Pohjanpalo

Director
Finnish Plastics Association

REPORT from FINLAND

The pioneer company in the plastics field in Finland was established in 1921, and at the outbreak of the war in 1939, there were only about 15 plastics factories. Today there are about 300 plastics companies and captive plants—employing some 3500 people—in operation.

The annual consumption of plastics materials is estimated at some 83 million lb. (18 lb. per capita). The bulk is imported (about 9% *ad valorem* from the U.S.A.). The small domestic production of plastics materials is mainly confined to the manufacture of glues, some phenolic and melamine powder, casein plastics, and rigid sheet. Last year a new product was introduced when Oy Suomen Synteesi Ab started the manufacture of acrylic sheet by polymerizing imported monomers.

The rapid development of the chemical industry in Finland during the past few years has opened new possibilities for domestic production of plastics materials. The first oil refinery, which went on stream towards the end of 1957, may give the needed impetus to thermoplastics manufacturing in Finland.

The Finnish economy is based largely on wood. Consequently, it is only natural that various plastics raw materials are being more and more used in combination with wood products. Here are some examples:

As the world's largest exporter of plywood, Finland is now using increasing quantities of urea and other bonding resins. Another interesting recent development is the use of urea resin in making chip board. And emphasizing the high quality of Finnish decorative laminates is the fact that these materials, despite strong competition, have gained a foothold in the international market.

Application developments

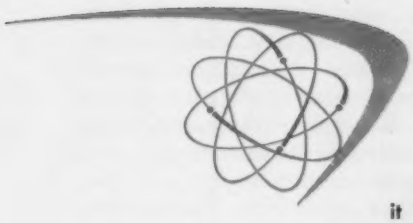
Building activity in Finland continues to be lively, especially in the urban areas—and plastics play an important role. Several large plants are currently researching plastics building materials suitable for the climate of the northern countries. The Finnish architect is often without prior prejudices in his planning, yet conservative and careful in his choice of materials. Yet Finnish architects are giving much attention to plastics.

Finland is today one of the half-dozen countries in the world that is a major force in the design of furniture, housewares, lighting fixtures, and utensils. In the past few years Finnish designers have put plastics to good use in these areas, winning world-wide recognition.—**End**

EMPHASIS ON PLASTICS in Finnish building industry is demonstrated by reinforced plastic outer walls, PE moisture barriers, and vinyl floor tiles of this summer house.

For plastics suppliers, processors, and end-users, six predictions on:

The shape of things to come



As the decade of the "Sixties" starts rolling, it is sweeping in with it revolutionary concepts that are sure to affect future uses for plastics materials. Six trends stand out; and on the following pages are detailed the applications that foreshadow them:

To meet the profit squeeze brought on by peregrinations in raw materials pricing, suppliers will come up with new formulations and refined processing techniques that can expand market potential—and command a well-deserved premium price. The vinyl-foam fabric combinations described on pp. 162-164 is one step in this direction. Look for it to affect tomorrow's markets for coated fabrics.

The economic battle between plastics and conventional materials, e.g., metals, wood, glass, etc., will hinge on industry's ability to spell out the tremendous cost savings that can be had by taking advantage of the unique design flexibility inherent in plastics. This will take the onus off the demand for more and more price cuts in raw materials and place it in such logical areas as design for parts reduction. In the transportation field, an imaginative approach to RP design in automobiles (see pp. 165-167) points the way out to other end-users.

As the range of available resins grows larger and larger; as the tough, new engineering materials expand plastics potential into areas heretofore dominated by metals; as new processing techniques appear, we can expect a new sophistication in materials selection. In the future, a single product may combine as many as 10 different plastics—each chosen to fulfill a specific function. Case studies on four new products—a scrubber-waxer, a bilge pump, a garbage disposal unit, and a soda dispenser—point the way (see pp. 168-171).

Captive operations, with vast amounts of money invested in materials inventory and processing facilities, will join custom processors in developing innovations in plastics use and production. Admiral, a pioneer in the use of thermoformed refrigerator door liners, points the way by setting up a production line for turning out the first entire food cabinet liner in plastics to be made in the United States (p. 172).

Mass production demands will bring on new refinements in the art of automation aimed at pushing plastics into ever-widening market area. The Princess telephone (see pp. 174-175) is a good illustration of what is being done in this area.

The body of knowledge and the successful case studies that have been accumulated over the years will finally result in the "Sixties" in cracking open for plastics those convention-bound industries fettered by tradition. For example, the furniture industry is already undergoing a revolution in the use of molded plastics chairs: plastic frames, foamed upholstery. The article on pp. 176-177 traces the development.

FOAM: an extra "hand" for vinyl-coated fabrics

The excitement attendant on the introduction of techniques for producing calendered or cast vinyl foam-coated fabrics has been so intense that the more enthusiastic supporters of the idea are already predicting that it will eventually take most of the play away from conventional methods of coating fabrics with straight vinyl.

In 1960, it was estimated that some 12½ million yd. of vinyl foam-coated fabrics were produced (in 54-in. widths) by the eight major companies in the field. By the end of this year, the figure will almost have doubled to anywhere between 20 and 25 million yards. By 1964, the conservative estimate is for a minimum annual production of 38 million yards. And while no one is making any predictions beyond that point, expectations are high!

Offering the soft hand and feel of fine leather, yet from one-third to one-fourth the cost, with better drape and more serviceable characteristics than conventional vinyl coatings, the new material seems justified in meriting all the optimism.

In essence, the coated fabric is a 3-ply sandwich—fabric backing, foamed vinyl core, and straight vinyl skin. It is the cushion-like core that gives the material the characteristics that make for improved comfort when it is used as upholstery or in outerwear garments.

In like fashion, the lower density of the cellular core results in a greater bulk-per-unit-of-weight factor and gives better drape and feel than conventional vinyl-coated fabric (see table at right). And since the material is basically a sandwich construction, the foam core offers excellent insulating values. It acts as a barrier against immediate heat build-up in the summer, and serves to retain heat in the winter.

Currently, major applications for the foam-coated fabrics have been in upholstery and outerwear garments. In the latter area, in fact, the material is expected to revitalize the market for simulated leather jackets (see photo, below), which were in such vogue a few years back. Automobile headliners, handbags, shoes, and slippers

CROSS SECTION sketch of foam-coated fabric shows sandwich construction. From top: vinyl skin, foam vinyl layer calendered to skin, and the fabric backing to which vinyl laminate is adhered.

NEW MATERIAL may revitalize market in vinyl outerwear through its combination of "body" with light weight. Photo, U. S. Rubber

are other current applications. But manufacturers feel this is only the beginning. Because porosity of the foam core can be controlled, the material can be adapted to the manufacture of the so-called "hard leather" products, *e.g.*, book covers, brief cases, toilet kits, etc., by increasing density. In contrast, if low levels of blowing agents are used in the coatings, reductions in coating weights are possible without loss in gage. Using as little as 0.05 p.h.r. (parts per hundred resin) of blowing agent, 20-mil film can be increased to 26-mil film, retaining the general properties of the unblown coating while providing softer hand.

Table: Bulk/unit of weight of foamed vs. conventional vinyl[a]

	Outerwear		*Upholstery*	
	Conventional	*Foamed*	*Conventional*	*Foamed*
Weight/sq. yd./oz.	14	14	18	18
Thickness, in.	0.022 to 0.025	0.035 to 0.045	0.025 to 0.029	0.040 to 0.050

[a]Prepared by The General Tire & Rubber Co., Bolta Products Div.

Soft-side luggage, automotive trim, sporting goods, and textured wall covering and flooring are other potential markets.

The calendering technique

According to U. S. Rubber, which is promoting its blowing agents for foam-coated fabrics, the calendering technique works like this:

A chemical blowing agent in "solid form" is first added to the formulation. A typical recipe would be 100 parts of vinyl chloride resin, 80 parts of plasticizer, 3.5 parts of stabilizer, and 5 parts of blowing agent. Calendering is done in the normal manner, taking care only that temperatures be kept below 340° F. so that the blowing agent does not decompose.

To complete the construction, the vinyl foam formulation can be calendered directly onto the fabric base, using conventional coating techniques, or it can be calendered onto unsupported "unblown" sheeting that can subsequently be laminated to the fabric backing by adhesives or with heat and pressure. And since most textile and upholstery applications require a solid wear surface, a straight calendered vinyl film is also laminated to the unblown base.

The entire 3-ply sandwich—film surface, unblown core, and fabric base—is then passed through an oven at temperatures in excess of 380° F. At these temperatures, the agent decomposes and the blow is effected.

Since a high-temperature blowing agent is needed for calendering, the azodicarbonamide type has been most active in the field. This agent decomposes above 350° F., hence foams after fusion (conversion of the vinyl formulation from the dispersion phase to the homogeneous phase), and produces a foam that has up to 95% closed cell construction.

Foam-coated fabric by casting

When using the dispersion-coating technique, the most common procedure involves first casting the top-surface vinyl film layer on a metal belt or other release surface. After this layer has

Photo, Bolta Products Div., General Tire & Rubber Co.

FOAM construction provides soft, supple, luxurious feel heretofore not common to vinyl-coated fabrics.

gelled, it is then passed through a reverse roll coater and the vinyl plastisol formulation with the blowing agent incorporated into it is laid on top of it. This is immediately followed by lamination to the fabric base. The combination is then passed through an oven for simultaneous blowing of the foam core and fusion of the three elements into a single-unit construction.

Azodicarbonamide blowing agents are also in wide use in this type of manufacture. Under certain conditions, NTA (N,N′-dimethyl-N,N′-dinitrosoterephthalamide) agents, **(To page 303)**

. . . and why not nitrogen as a filler?

The concept of "controlled porosity" on which the vinyl foam-coated fabrics are based has more significant meaning to the plastics industry than first meets the eye. Simply stated, it is this: if you can control the density of vinyl resin in calendered or cast coatings, then you can control the density of vinyl—or any other resin—in extruded or molded products. Basically, you would simply be substituting a nitrogen gas system for the conventional type of fillers now used by the plastics industry to cut costs—and you would be improving the product at the same time.

U. S. Rubber, which has again done research on the use of its Celogen AZ blowing agents and Marinol vinyl compounds in such applications, reports that extrusion techniques have already been developed and injection molding techniques are in the process of development. In essence, the blowing agent in "solid form" would simply be incorporated into the extrusion or molding compound by tumbling or Banbury mixing. During extrusion or molding, the agent decomposes under heat to create the cellular construction. But here's the trick—by controlling the amount of blowing agent incorporated, by careful mold or die design, and by balancing the heating and cooling cycles, a construction can be created that offers a solid plastic skin and an *integral* cellular core. The theory is that the bubbles or "cells" move away from cooler areas, *e.g.*, mold walls, to the hotter sections in the center of the plastic mass.

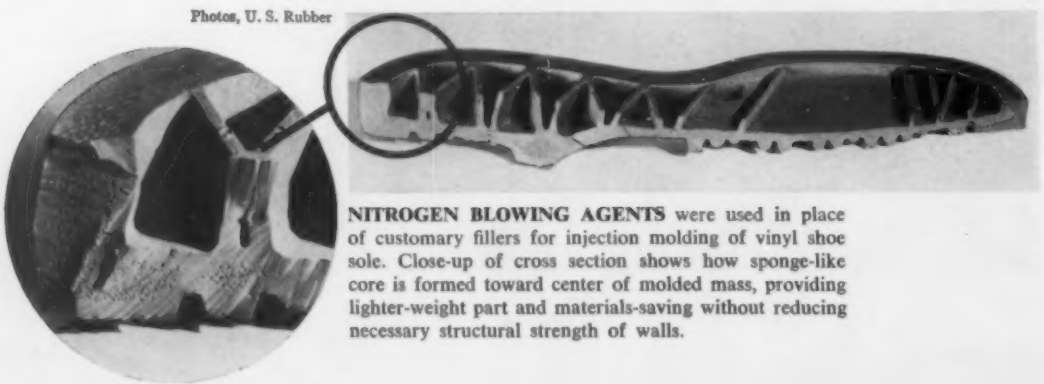
Remember that the blowing agent is used in minute quantities, hence the cellular construction in the center of the part is relatively slight and density is relatively high. This is intended to keep the solid outside skin as the "structural element" of the "sandwich" and to keep the reduction in physical properties to an absolute minimum. But the foamed core is still sufficient to cut total density of the part from one-fourth to one-third—with attendant cost savings.

A new development by Goodrich is the use of the technique to extrude a cellular vinyl jacket now approved by Underwriters' Laboratories for non-metallic sheathed cable construction and for underground feeder cables. Heretofore, two types of construction were in use. In one, the vinyl primary insulation was covered with paper paired with jute and jacketed with cotton braid impregnated with asphalt and dusted with mica. In the second, a solid vinyl sheath was used. Price, however, held the solid vinyl back. Now, through use of controlled porosity, it is expected that the cellular vinyl jacket will meet—or undercut—the cost of the asphalt-impregnated jacket.

Injection molding with the concept of controlled porosity is already being evaluated for shoe parts, handles, knobs, etc. The rule-of-thumb is that as little as 0.05 to 0.1 or 0.2 p.h.r. of blowing agent will effect a density reduction of from 5 to 15 percent.

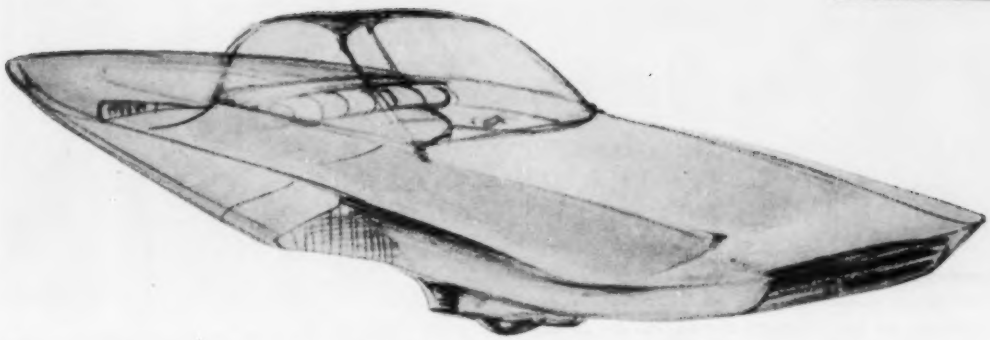
While most of the work has concentrated on plasticized vinyl, other resins have also been successfully test-molded.—**End**

Photos, U. S. Rubber



NITROGEN BLOWING AGENTS were used in place of customary fillers for injection molding of vinyl shoe sole. Close-up of cross section shows how sponge-like core is formed toward center of molded mass, providing lighter-weight part and materials-saving without reducing necessary structural strength of walls.

Photo, J. P. Stevens & Co. Inc.



LIGHT WEIGHT of reinforced plastics suggests their use in designs of vehicles of the future, like this "air-car," which floats on a cushion of low-pressure air.

Creative thinking about the car of the future gives the automotive industry a basic grounding in:

Economics of engineering with RP

By Irwin J. Gusman*

Reinforced plastics (RP) offer a two-fold challenge to the automotive industry: 1) a challenge to recognize the immediate advantages of structural plastics in today's cars and 2) a challenge to explore the full potential of the materials in designing the cars of the future.

It is an established fact that fibrous glass-reinforced plastics make an excellent car body. Chevrolet has more than 43,000 Corvettes on the road to prove that it offers motorists a well-styled, corrosion-resistant, strong, lightweight body. But the economics of car manufacturing are such that even a superior material must match or better the cost of the material it replaces. Reinforced plastics cost a little more than steel, pound for pound, and they usually take more time and labor to fabricate.

However, it is the *total fabricated unit cost* that is important, and here we believe fibrous glass-reinforced plastics offer some unique opportunities. Reinforced plastics also have two big economic advantages—much lower tooling cost and a moldability that permits reduction in number of parts to be used.

*Manager, Industrial Glass Fabrics Dept., J. P. Stevens & Co. Inc.

Economics of RP processing

Today, on the average, it is easily possible to build about 25,000 reinforced plastic bodies before the higher costs of materials and fabrication deplete the savings on tooling. This break-even point has risen steadily as resin and glass prices dropped, steel prices rose, and plastics processing improved. A few years ago, molding cycles for typical RP parts were 3 to 5 min.; today, the same parts can be formed in 20 to 50 seconds. It is safe to predict that the engineer who starts today to design a structural plastic body will have improved resins, better glass, and faster, more automated fabrication to help him.

The Corvette program has operated profitably within this economic volume limitation. The growing segmentation of the automotive market and the proliferation of models may well mean

Photo, U. S. Dept. of Commerce

AIR CARS are not just designers' dreams, but are already an actuality. This one has RP body by Molded Fiber Glass Body Co., was demonstrated at Trade Fair in Tokyo. Driver-owner is U. S. country doctor who plans to use it for rounds in Illinois.

that there are other opportunities *right now* for profitable production of RP car bodies.

The weight-conscious trucking industry, with its many models and low production totals, for example, is a natural market for RP, and we can already see its increasing use for truck cabs by White, Brockway, Ford, and for truck bodies by Heil and others. Reinforced plastics will also be fabricated into panels by Continental Can Co. to use as a liner for the cargo section of the new Boeing 727 medium-range jets.

Economies in parts reductions

There is evidence, though, that reinforced plastics can transcend volume limitations by use of their second cost advantage: the ability to reduce number of parts required. We can have a plastic heater duct because it can be molded in fewer pieces than metal requires and we save money on assembling the pieces. That is a signpost! We can have a phenolic-glass headliner on the 1961 Rambler because this one-piece unit replaces framing, fasteners, insulation, and fabric—and can be snapped into place quickly and economically. The headliner is another significant signpost! Here, the cost per pound of resin and glass, the slowness of the molding cycle, the labor cost per unit—all were overshadowed by the greater savings achieved when imaginative design engineers utilized the inherent advantages of the plastic materials.

Remember, too, that this kind of advance was made with existing materials. How much further can we go when improved resins and reinforcements start to show up? Just one of the forerunners of new, higher-performance materials for reinforced plastics now coming out of the research laboratory is a new high-modulus glass fiber containing 8% beryllium oxide. This new glass formulation results in fibers with 50% higher modulus of elasticity than present glass fibers used for reinforcing plastic material. When this beryllium-oxide glass composition is embedded in the plastic matrices, it provides impressive improvements in rigidity without sacrificing strength.

Whether in single plastics parts that replace several pieces of other materials or in all-plastics bodies, the industry needs to take full advantage of possible parts reduction. The Corvette has about 80 body parts in spite of some impressively large moldings like its one-piece underbody. But note that the same manufacturer who makes the Corvette body, The Molded Fiber Glass Body Co., collaborated with Creative Industries on a compact car design that calls for *only 11* body parts. This is conceived as a practical, economical product, conventional in appearance, suitable for today's market.

Even this is not the ultimate. Simple monocoque, or shell-like, constructions can be achieved with inherent strength and rigidity. Whatever framing or stiffeners are required can be molded in. There is ample precedent for this in current practice. Boat hulls now being produced in one piece on matched metal molds with framing molded-in are just one example.

Possibilities for one-piece design

We see a one-piece headliner today. Why not go a step further and combine roof and headliner? Interior trim and styling may be a part of the body shell. The trunk, gas tank, and spare

tire well conceivably can be achieved in one molding. So too might the floor pan be combined with the covering material. In addition, the instrument panel, fire wall, and plenum chamber will be molded as one piece. The doors may be of sandwich construction with decorative plastic facings supported by plastic honeycomb.

All of us are well aware that the lack of interior space is becoming an increasing limitation to the automotive stylists and engineers. In the compact cars, it is desirable to increase interior space while the outer envelope is decreased. Shell-type construction is an obvious answer.

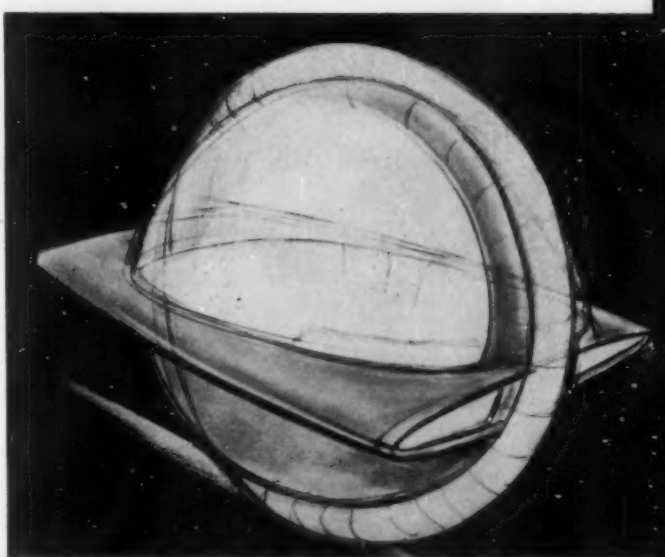
When we *do* have to assemble parts, we'll do it swiftly, cheaply, and permanently with adhesives. There's nothing visionary in that—the parts of the White truck cab, for example, are bonded together, as are many parts of today's modern jet aircraft. I wonder how cheaply we could produce pre-impregnated glass fabric if some car manufacturer decided to use it for automated high-volume production?

What about the future?

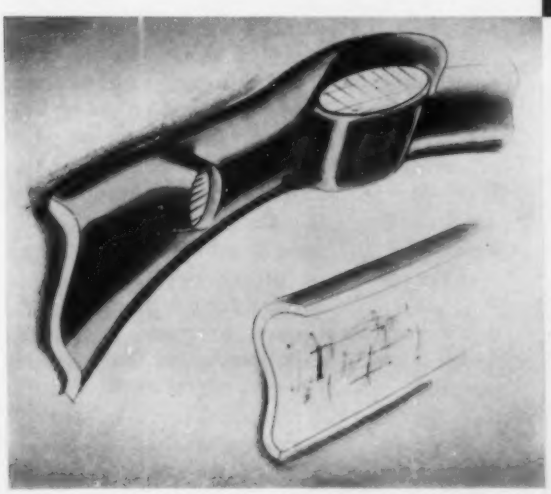
So far we have been talking about cars to meet today's requirements, about the advantages of reinforced plastics in a fairly conventional vehicle. But we are teetering on the edge of a new technology of transportation, a world in which the advantages of our materials will be magnified.

It appears to us, looking in on this dynamic automotive industry, that it is again in the midst of a major transition in designing and engineering. Every automotive engineer has done some serious soul-searching about the car of tomorrow: the impact of fuel cells on body engineering; the lessons of space-propulsion; the penetration of electronic devices in automobile travel; the emergence of electroluminescence; advance thinking in fluid mechanics and systems; developments resulting from the field of cryogenics and advanced semiconductors; and the potentials of microwave, sonic, solar, and infra-red forms of energy. The industry has been researching new modes of transportation which include ground-effect machines or air-cushioned cars; uniwheel vehicles, amphibian and "triphibian" cars.

In tomorrow's highly versatile vehicles, lighter weight and greater strength become imperative. These versatile machines will demand that structural strength be built-in, to assimilate entirely different types of stresses and strains connected with each varying type of **(To page 304)**



UNIWHEEL car is one car design projected for future. It would have gyro-stabilized body of fibrous-glass reinforced plastics, single tire of plastics formulation with tread life of 200,000 miles.



ELECTRICAL circuitry integral with molded car parts was designers' dream yesterday, is already incorporated in present-day cars. Artist's sketch shows how die cut "printed" circuit is incorporated in dashboard.

Photos, J. P. Stevens & Co. Inc.

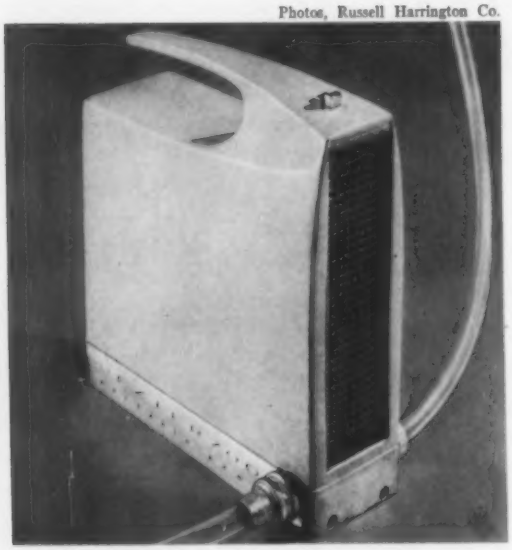
PICKING THE RIGHT PLASTIC

A PRACTICE once quite common to plastics end-user industries—shopping around for that single "best all-around" resin for a multi-component product—is now becoming about as out-of-date as the cranked telephone!

As the number, type, and variety of plastics materials commercially available have increased, the sophistication shown by modern-day manufacturers in selecting the right plastic for the right job seems to have grown proportionately. The result has been a sharp upturn in the number of soundly engineered plastics products appearing on the market—products in which as many as seven different plastics

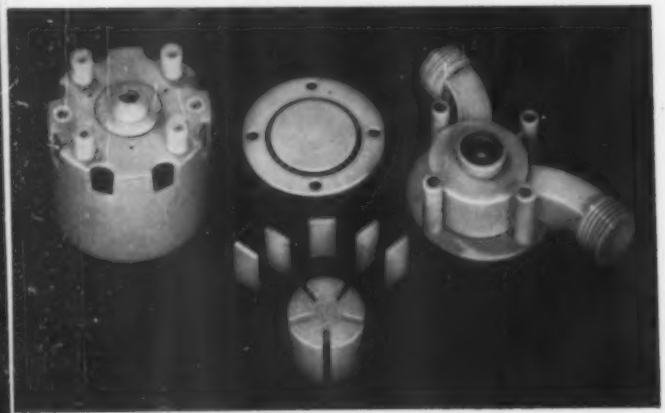
Portable pump: compact design at less cost

Photos, Russell Harrington Co.



FOUR MATERIALS are used in bilge pump: ABS for housing, corrosion-resistant vinyl for hose . . .

. . . molded acetal for pump and pump housing, and (bottom, center) nylon for rotor and rotor vanes which rotate within housing.



A completely automatic, self-contained portable pump—the first of its kind—has come on the market with four major plastics components, and with its entire packing container molded of expandable styrene. And here's the twist: so desirable and so economical were the plastics parts involved that the product itself was actually redesigned to eliminate an operating problem that might well have taken plastics out of consideration for the job.

The pump, called the Dexter and manufactured by Russell Harrington Co., Southbridge, Mass., stands only 12 in. high, 10 in. long, and 4 in. deep, weighs about 18 lb., and sells for $69.50. It will run continuously for 7 hr. on one battery charge (recharging is via 110-v. outlet) and can pump 3 gal. a minute. And its uses are many: as a bilge pump, fire extinguisher, camp shower, oil pump for inboard motors, cellar pump, trailer water supply, etc.

The four major plastics parts are: the molded acrylonitrile - butadiene - styrene outer housing (chosen for its outstanding impact strength and chemical and weather resistance); a molded acetal pump body and pump housing (chosen for its light weight, toughness, corrosion resistance, and proven economies over machined bronze and die cast metal parts); nylon pump rotors and vanes (chosen for abrasion resistance and the fact that it eliminates any problems of seizure or scoring when rotating within the acetal housing); and a corrosion-resistant transparent vinyl hose that allows the user to see the passage of liquids.

It was the use of acetal for the pump body and housing that occasioned the change in product design. As originally produced, the operating temperature of the pump's motor was too close to the upper limit of the acetal parts. In terms of light weight, cost savings, and adaptability to compact design, however, the advantages of the

FOR THE RIGHT PART

have been skillfully combined to achieve a functional, aesthetic, and economic goal. The only trick seems to be an awareness of the wide range of characteristics that the family of plastics has to offer—from competing on a properties basis with metal to undercutting the already-low cost of glass.

Described on the accompanying pages are the case histories of four such products and the thinking behind their successful use of plastics. Note how each type or grade of plastic was used only insofar as it could do the job required. And above all, note the emphasis on new materials and new processing techniques.

plastic were so spectacular that the manufacturers decided to stick with acetal—and *redesign the motor*. They settled on a new type of motor that delivers one-thirtieth the horsepower with only about one-half as much heat rise and amperage draw as previous models.

Expandable styrene was chosen for the contour container in which the pump is shipped because of its obvious weight savings, cost savings, shock-absorbent features, and the fact that it could be reused as a storage container.

Credits: Delrin acetal and Zytel nylon—Du Pont; Kralastic ABS—U. S. Rubber. Pump design—Franklin G. Umholtz. ABS housing molded by Produx Co., Shrewsbury, Mass.; acetal and nylon parts molded by S & M Mfg. Inc., Southbridge, Mass.; styrene case molded by Preferred Plastics Corp., North Grosvenordale, Conn.—**End**

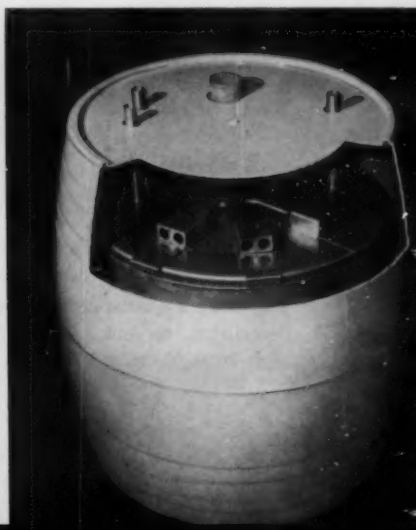
Drink dispenser: foam insulation makes switch to plastics possible

Paradoxically, the newer materials joining the growing family of plastics seem to result more often in widening over-all markets for plastics than they do in taking away any existing markets from old-line plastics. A case in point is a new soft-drink post-mix dispensing barrel formerly made with wood or metal housings and now being produced with an acrylic housing—thanks to another plastic: a pour-in-place urethane foam that gives the insulation characteristics, structural strength, and rigidity necessary for the switch.

As used by Multiplex Co., St. Louis, Mo., the urethane is foamed-in-place to fill the cavity between the inner metal ice-chest body, and the two-piece housing molded of impact acrylic—the largest part to be molded of the material thus far. Prior to the availability of urethane foam, there was no practical way to fill the cavities and to reinforce the outer housing adequately, and, hence, plastics could not be used. With urethane, however, plastics came into the picture and gave the manufacturers an opportunity to produce units that are more attractive, more sanitary, and easier to maintain than equipment made of conventional materials—with production economies to boot!

The main structure of the Multiplex injection-molded barrel consists of only **(To page 315)**

Photos, Nopco Chemical Co.



BARREL of dispenser is made in two halves, said to be largest impact acrylic units ever molded. Cut-away view shows metal ice chest and space between it and barrel walls which will be filled with urethane foam.

EXPLODED VIEW of Hoover floor-care appliance shows many of the 33 parts which are made of one of the 7 different plastics used in the device. Letters denoting major parts are keyed to text to identify part and resin from which it is made. Photo, The Hoover Co.

Floor scrubber-waxer: 7 plastics in 33 components

In the new Hoover shampoo-polisher (Model 5240)—a stylish, multi-duty appliance that can shampoo rugs or clean and polish floors—seven plastics go into 33 components that make up over one-third of the total weight of the unit (5¼ lb. of plastics out of a total of 15.3 lb.). And further emphasizing diversity is the fact that 25 out of the 33 plastics parts are injection molded, four are compression molded, three are extruded, and one—for the first time—is blow molded.

Here's the scorecard on what plastics were used, where they were used, and why:

Polypropylene went into three major components: the main housing (A) and the top (B) and bottom (C) covers of the detergent tank. Reasons for the choice: 1) Polypropylene combines high surface gloss with the translucency required to keep the level of fluid in the container visible to the user; 2) outstanding resistance to attack by detergents, solvents, greases, and oils; and 3) a high strength-to-weight ratio that makes possible a lightweight tank yet rugged enough to take the abuses of everyday use (filled tanks successfully passed 36-in. drop tests). All three parts are injection molded, and heat sealed together.

Polyethylene, high density, got the nod for the "second tank"—actually a removable blow molded squeeze bottle (D) stored in a special pocket along the handle behind the main tank. This hand-operated 1-pt. bottle is used to store and dispense the liquid petroleum-base solvent-type waxes used to polish the floor—and it was high-density PE's resistance to the wax that dictated its choice. (Detergents for shampooing the rug are stored in and dispensed from the polypropylene tank.) Since the petroleum-base wax also has a tendency to "jell," the positive pressure of the squeeze bottle is necessary to dispense the wax. High-density PE is also used for the toggle spout (E) of the squeeze bottle and for the distributor tubes (F), which channel detergents or waxes from tanks to brush backs. **(To page 311)**

Garbage disposal unit: 4 models from only 2 extra parts

The creative application of seven different plastics to the design of a garbage disposal unit manufactured by In-Sink-Erator Mfg. Co., Racine, Wis,, has resulted not only in improved performance but also in actually adding merchandising appeal to a seemingly mundane household appliance. Average weight of plastics used is over 2 lb. per unit.

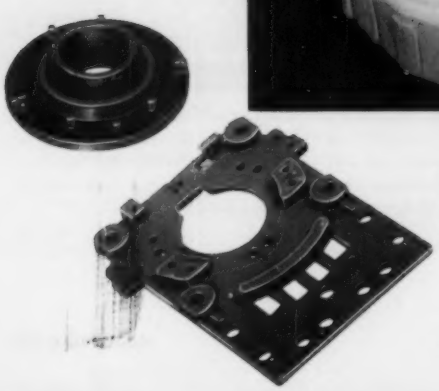
Four new models of the disposal unit introduced this year served as proving ground for the use of the plastics. And it is interesting to note how the manufacturer used the plastics components to give a different look to each of the models —with a minimum investment in tooling costs! Key idea was designing the main housing in a minimum number of parts that 1) could telescope together so various combinations are possible and 2) could be post-decorated in different colors.

There are only four parts that combine to make up the four models. The main central unit of the housing, which appears on all four models, is molded of white, high-heat, high-impact styrene. It measures 9¾ by 8¼ by 10½ in. deep, and weighs 22 ounces. This material was specified for the job to provide adequate support for the relatively heavy appliance (total weights range from 23 to 42 lb.) without breaking in shipment or installation and to prevent possible distortion from the heat which might be generated by the enclosed electric motor in the event of abnormal loading. The styrene specified also offered savings of up to 50% over other plastics that were considered for the job.

For the two top models in the line (equipped with more powerful motors), the bottom of the styrene central unit has an opening cut-out into which is fitted a lower base section molded of clear acrylic. The acrylic was **(To page 321)**

Photos, In-Sink-Erator Mfg. Co.

GARBAGE disposal unit and parts which are used to form four different models (clockwise from assembled unit): main housing (impact styrene), top collars, deluxe and standard (impact styrene), metallized Mylar facings and name plate; two-piece noise-muffling collar (styrene foam), and base plate (acrylic) used on two models. In center are pictured the plugs (impact styrene) for sealing electrical and plumbing openings.



THERMOSETS are used in two parts of switch mechanism shown at left. Circular switch is compression molded phenolic, base plate is alkyd.

FINALLY—A FORMED

It has always seemed logical, considering the success that thermoformed high-impact styrene inner door liners have had in the refrigerator industry, that some forward-looking manufacturer would eventually set the wheels in motion to adapt the same material and the same production technique to turning out the entire food cabinet liner. It comes as no surprise then that the move has finally been made—and that every appliance manufacturer in the United States is already watching the development with avid interest!

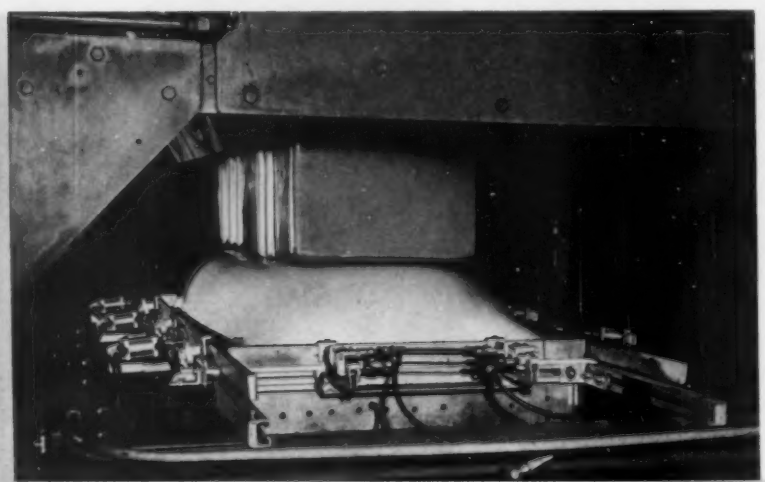
The liner, intended for a 9-cu.-ft. refrigerator and claimed to be the first such unit to be made in this country on a production basis, is a relatively large job. It stands 46½ in. high, is 22¾ in. wide, and is slightly more than 20 in. deep; with an average wall thickness of about 0.100 in., it weighs some 15 pounds.

The manufacturer, who is producing the liner for one of its 1961 model refrigerators at its captive plant in Galesburg, Ill., is appropriately enough the Midwest Mfg. Corp., a subsidiary of Admiral Corp., one of the early pioneers in the

Assembly-line

AUTOMATED production of food cabinet liner for refrigerator starts with extrusion of 0.300-in. high-impact styrene sheet, which is trimmed to size by shear controlled by electric-eye. Sheets are locked in a 3-station rotary forming machine and heated at 300° F. for about 2 min.; electric eye shuts off heat when softened sheet sags and breaks beam. Sheet is blown into bubble by injecting compressed air (this facilitates forming and avoids mark-off); an electric eye is used again to control height of bubble.

Photos, Admiral Corp.



MALE PLUG descends onto blown bubble, pushing the sheet into the cavity of the water-cooled cast-aluminum mold where vacuum is then drawn. Forming is at 160° F. Cooling is facilitated by 4 fans (top left) that turn on automatically when plug is withdrawn. Baffle plate below fan deflects cool air from plug to part.

FOOD CABINET LINER

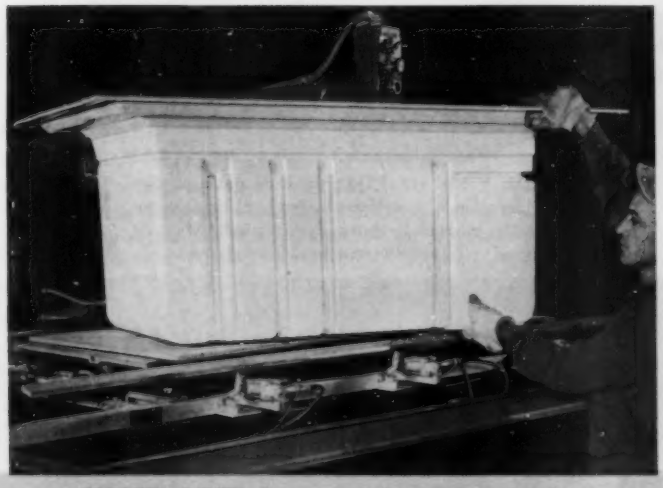
Refrigerator manufacturer adapts the technique used for styrene door liners to produce the first U. S. model with an entire food storage section lined with plastic—and does it on an assembly-line basis

use of styrene door liners. According to company management, the choice of high-impact, low-temperature styrene for the job was dictated by much the same reasons that prompted its selection for the door liners: "By using styrene, we can create a cabinet liner that cannot chip or rust and that has integral coloring. The breaker frame can be formed as part of the finished liner, thereby eliminating the unsightly joints associated with previous assemblies. Drawer rails, shelf support grooves, and other details are also formed directly into the liner. This means, of course, that although the initial material costs of the styrene are higher than the steel-porcelain combinations used in other models, costs of handling and assembly are considerably less. The impact strength and the excellent thermal insulation characteristics of styrene were additional factors which motivated our choice of this material.

Once having decided upon the plastics construction, Midwest engineers then went to work on setting up a smooth-running production line (as illustrated in the accompanying series of photos) that would put the manufacture of the unit on a commercial basis.

Credits: Styrene material supplied by Dow (Styron 475 B) and Monsanto (Lustrex 88). Automatic three-station rotary vacuum forming machine, Brown Machine Co., Beaverton, Mich. Mold for forming liner, Miller Pattern Co., Saginaw, Mich. Automatic shear, Famco Machine Co., Racine, Wis.—**End**

processing of food cabinet liners



FORMED LINER is removed from rotary forming machine. Forming cycle is approximately 2 minutes. Note integrally formed ribs, shelf supports, and breaker frame, which keep finishing operations to a minimum. Liner will now be punched and trimmed.

WORKMEN lower finished styrene liner into 9-cu.-ft. steel refrigerator cabinet. Layer of glass fiber between components provides insulation. Integral breaker frame eliminates need for joints at front of cabinet.

New Princess telephone foreshadows increased use of

ENGINEERING MATERIALS

As a long-time volume user of plastics materials, it was quite natural for Bell Laboratory's designers when faced with the problem of creating a new type of telephone—compact, lightweight, and stylish—to turn again to plastics. It was just as natural, in a later planning stage, for Western Electric Co.'s engineers to put their talents to work on automating many of the aspects of the molding operation to bring them in line with the production speeds called for by the manufacturing set-up at Western Electric's huge Indianapolis plant.

In both instances, design and engineering goals were achieved—and plastics had done it again! The result: American Telephone and Telegraph's Princess telephone—already an established symbol of modern living.

Emphasis on the new

When plans for the Princess had been completed and a search was started for the proper materials of construction, the designers found that the choices open to them had been considerably broadened from the early days of telephone production to include a wide range of tough, new engineering materials in the thermoplastics family. And when they finally made a selection, after at least 18 months of testing, look at what they picked: acrylonitrile-butadiene-styrene (ABS), molybdenum disulphide-filled nylon, styrene-acrylonitrile, and acetal resins—materials that did not even exist when the first phenolic and cellulosic phones rolled off the assembly line back in the 1930's.

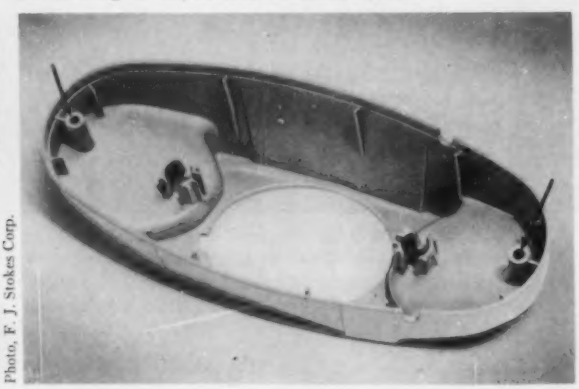
The choice of ABS for the main housing and other components of the Princess was a direct result of Western Electric's success with the material in some of the earlier color versions of the conventional phone. Competition for the job, of course, was cellulose propionate. Reasons for the selection of ABS: superior resistance to staining by tobacco smoke and cosmetics; a reported approximate 12 to 15% reduction in raw material cost; faster molding (e.g., an approximate 8 to 10% savings in cycle time); and a harder surface finish that did not require as frequent reconditioning (stained plastics phones previously had to be taken out by the phone company and refinished with lacquer—at considerable expense). Total weight of the ABS parts in the Princess set is 8.67 ounces.

For the pawl which is so important to the proper timing of the newly-designed dialing mechanism, acetal resin was the choice because of its ability to be molded to extremely close tolerances, its resistance to creep, and its excellent dimensional stability under high stress as well as variable humidity conditions. Strength in thin sections, good stiffness in flexure, resistance to moisture absorption, and excellent dielectric

TRIUMPH OF MATERIAL SPECIFICATION and processing technology, latest version of telephone overcomes problems of stain resistance, offers better performance through use of plastics.

Photo, Western Electric

INSIDE VIEW OF MAIN housing part. Arrows show location of two brass inserts which are automatically molded-in during production. Material for housing is acrylonitrile-butadiene-styrene.



Photo, F. J. Stokes Corp.

AND AUTOMATED MOLDING

strength were other factors dictating the choice of acetal resin for this part.

For the governor pinion and cam—also essential to the operation of the dial mechanism—molybdenum disulphide-filled nylon with excellent dimensional stability, toughness, good moisture resistance, and self-lubricating properties, got the nod. Like the pawl, the governor pinion and cam had to prove under test their ability to withstand the wear and stress encountered in more than 2 million operating cycles—a number which simulates actual lifetime use. In the governor pinion application, the molybdenum disulphide-filled nylon successfully replaced steel. And an added bonus derived from the change when Western Electric's engineers discovered that the plastic's characteristics enabled them to use a lighter weight aluminum drive instead of the heavier brass drive previously required. The use of filled nylon for the parts also contributed to the quiet operation of the dial.

In the design of the switch card and transmitter cup, styrene-acrylonitrile was chosen because of its lower cost and the fact that it can take eyeletting without cracking.

Automatic injection molding

At Western Electric's Indianapolis plant, key units of the production line are 11 injection molding machines— **(To page 328)**

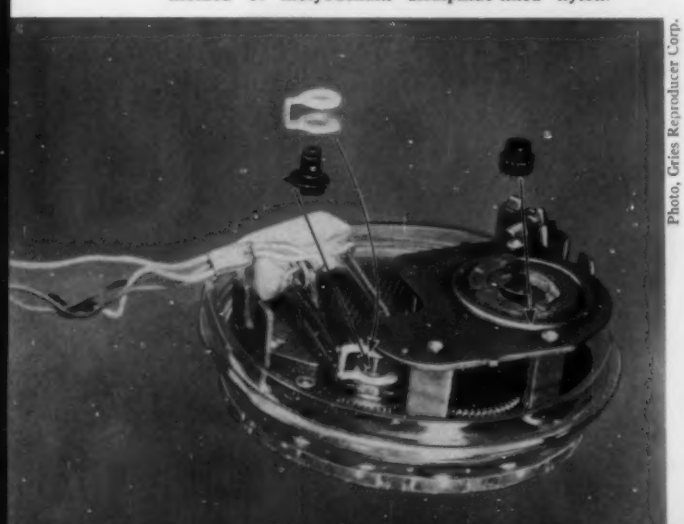
Photo, F. J. Stokes Corp.

AUTOMATIC INSERT-LOADING mechanism. Inserts are fed from vibratory bowl into four flexible tubes, each of which releases the inserts, one at a time, into loading tray (at bottom of photo). Tray then moves into die area and inserts are dropped into place in the mold.

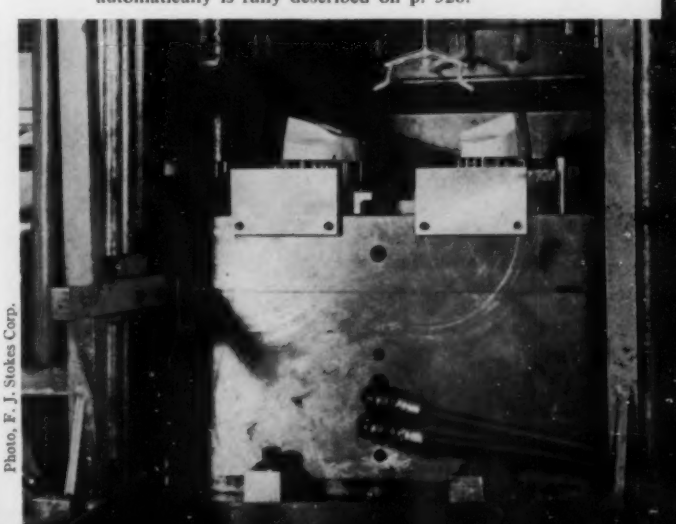
TELEPHONE HOUSINGS, just before ejection. The two parts are here shown raised on the ejector pins, with the runner already separated (top of photo) and about to be ejected separately. Molding the housings in a two-cavity mold proceeds fully automatically, including the incorporation of brass inserts. The unusual techniques developed to mold these inserts in automatically is fully described on p. 328.

CLOSE-UP OF DIAL MECHANISM. The light part is the pawl, molded of acetal. The two dark components are the governor pinion and cam, molded of molybdenum disulphide-filled nylon.

Photo, Gries Reproducer Corp.



Photo, F. J. Stokes Corp.



For tomorrow's furniture

MOLDED FRAMES

At this stage of the game, there can be no denying the fact that plastics materials have revolutionized traditional concepts of furniture making. As always, the trends are starting in the area of medium-priced furniture—where cost and volume requirements are the stimulants to try new approaches. But as more and more new plastics start to enter the field—and the gamut already runs from reinforced plastics, polyethylene, and polypropylene to urethane foams, vinyl foams, and expandable styrene foams—chances are that the use of plastics will spread to the higher-priced units and to low cost units.

In the design of upholstered chairs, the plastics approach is an obvious one: molded one-piece plastics frames and foam cushioning to replace the complexities of construction involving coil springs, fiber stuffing, and wood assembly. And because of plastics' versatility, they offer refinements to meet specialized needs.

The molded chair

Newest of such refinements to hit the furniture market involves the use of polyether-type urethane foam, cured in a mold around a supporting frame of tubular metal construction. Several chairs of this type were shown at the recent winter furniture market in Chicago by the Karpen Furniture Div. of Schnadig Corp. and are just going into volume production. Karpen's "Chair-Foam" collection grew out of the combined efforts of this company and The General Tire and Rubber Co., which does the urethane foam molding at its Marion, Ind., plant.

A "one-shot" molding method in which all of the components that go into the foam are added at the mixing head is used. Once the steel frame has been positioned in the mold cavity, the time required for the added liquid chemicals to "blow" and form the entire chair takes only a few seconds. The rigid frame is so supported in the mold cavity that during the foaming operation, a substantial amount of the urethane foam material completely surrounds it. The result: a one-piece upholstered chair, with integral frame and cushioning, that can be manufactured on a mass-production basis.

In addition to the obvious economies, the chairs are also light in weight, provide good support for the back, and will not mar walls or other

Photo, Karpen Furniture

AND UPHOLSTERY

surfaces, since there are no hard edges exposed. Longer life is an additional advantage claimed for the plastic chairs.

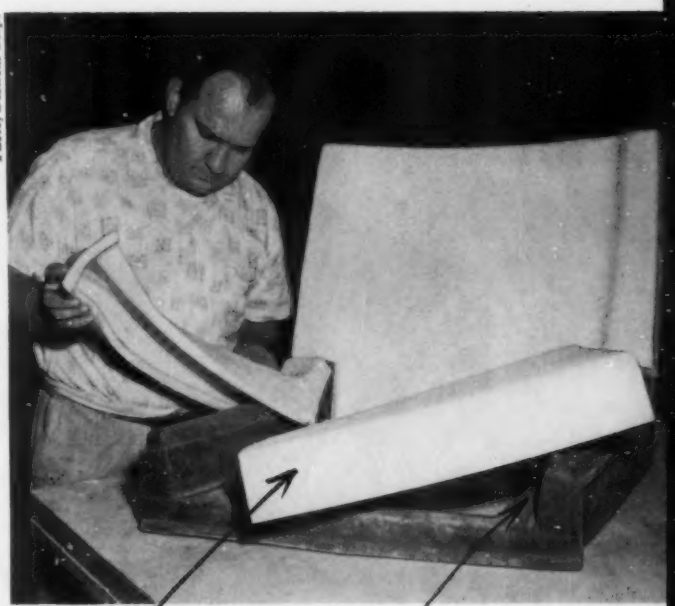
Molded frame, foam cushion

Most of the other plastics upholstered chairs on the market today involve a combination approach, using a rigid plastic shell supplemented by plastic foam cushioning made with or without an integral skin.

Molded polyester-glass shells were the pioneers in this area—and are still in use today. What seems to be limiting their further expansion at this time, however, is the difficulty of tacking upholstery fabrics onto the material. According to industry sources, improved formulations that may eliminate this problem are already being evaluated. And some manufacturers have found use of reinforced plastics so desirable that they have tried combination constructions designs, *e.g.*, RP panels attached to wood frames, that would enable them to take advantage of the material's properties.

Other approaches to the use of RP are also being taken, including compositions of wood chips, fibrous glass, and polyester resins that can be molded at 300 to 500 p.s.i. in relatively inexpensive molds (MPI, Feb., p. 150). Formulations of this type are capable of holding nails, tacks, staples, and screws.

Also creating considerable excitement in the furniture industry has been the recent introduction of the Image line by Prestige Furniture Corp., Newton, N. C. The rigid frame for the chairs in the line are slurry molded of a resin-cellulose fiber composition by Hawley Products Co., St. Charles, Ill. Resins involved include polyester, melamine, vinyl acetate, and a special solvent-based formulation. This is the same technique used by the company to produce luggage and involves the formation of a slurry of resin-impregnated fibers in water. The slurry is then passed through a screen shaped like a finished shell; the fibers, of course, cannot pass through, and build up on the screen into the finished unit. The shell is then heated to drive off moisture and the resin is cured. **(To page 335)**



Photo, Bostrom Corp.

Urethane foam cushioning

Slurry molded frame

Photo, Prestige Furniture Corp.

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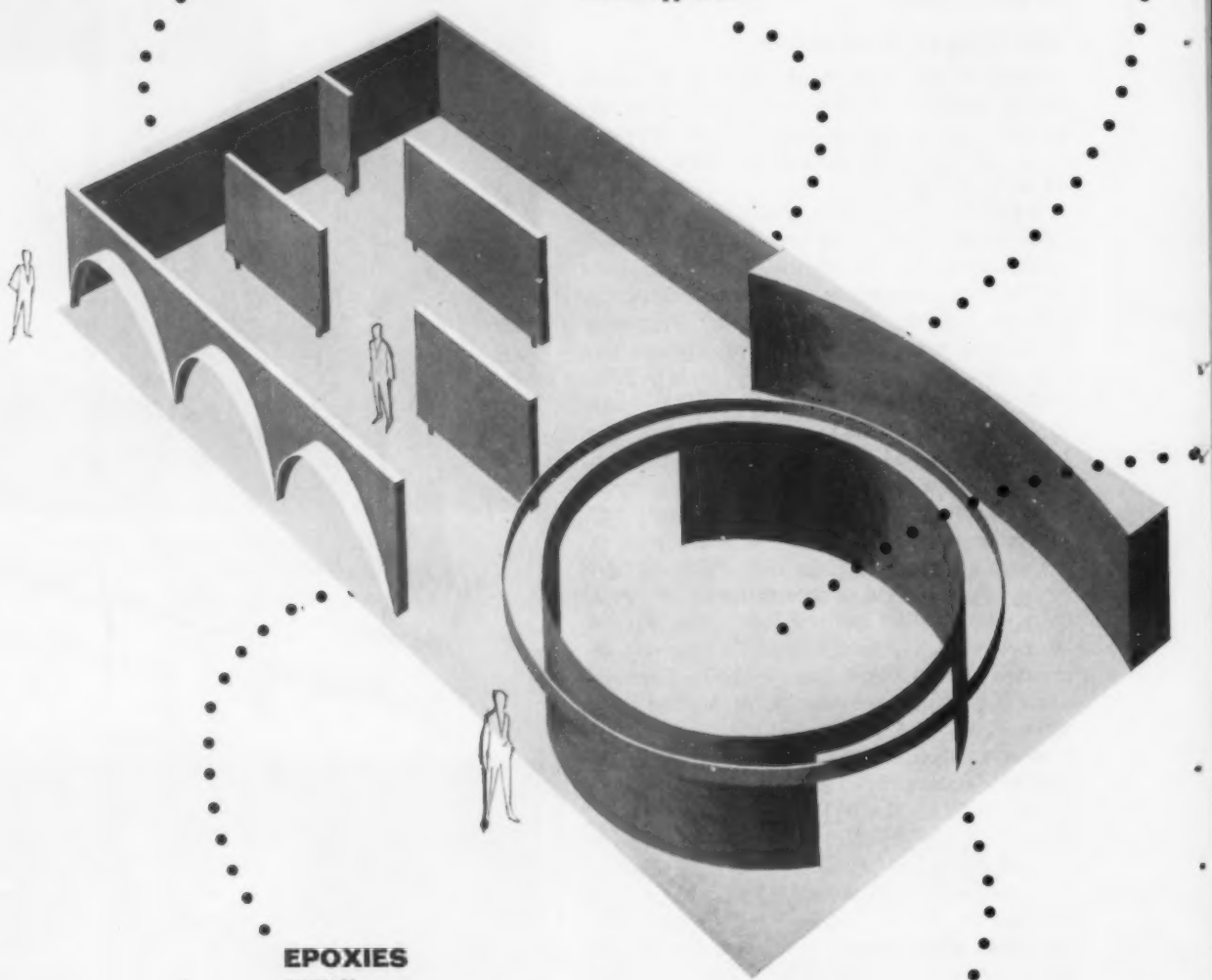

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Plastics federations around the world

To keep pace with the fast moving plastics industry, one must keep abreast of developments all over the globe. Important links in the exchange and dissemination of such information are the national organizations—of and for members of the plastics industry—listed below

Argentina: Camara Argentina de la Industria Plastics, Sarmiento 2494—T. E. 48-1047, Buenos Aires.

Australia: Plastics Institute of Australia, 30 Latrobe St., Melbourne.

Austria: Chemisches Forschungsinstitut der Wirtschaft Oesterreich, Sektion Kunststoffinstitut, Arsenal, Objekt 212, Vienna.

Verband der Kunstofferzuegenden Industrie & Verband der Kunstoffverarbeitenden Industrie, Wildpretmarkt 10, Vienna.

Plastic-Ausschuss, Mariahilferstrasse 116, Vienna.

Belgium: Organisation Professionnelle des Maieres Plastiques en Belgique, 32 Rue Joseph II, Brussels.

Brazil: Comissao Representativa dos Industriais, de Artefatos de Materias Plasticas e do seu Sindicato, Rio de Janeiro.

Chile: Association of Plastics Industries, Santiago.

Denmark: The Danish Plastics Federation, Bredgade 45, Palse 1879u, Copenhagen.

England: The Plastics Institute, 6 Mandeville Place, London.

The British Plastics Federation, 47-48 Piccadilly, London W1.

Finland: The Finnish Plastics Assn., Muoviyhdistys, Etelaranta 10, Helsinki.

France: Syndicat General de L'Industrie des Plastiques Renforces au Verre Testile, 3 Rue la Boetie, Paris.

Union des Syndicate de la Transformation des Matieres Plastiques et Naturelles Connexes, 3 rue Copernic, Paris.

Syndicat Professionel des Fabricants de Matieres Plastiques et de Resines Synthetiques, 9 Avenue Hoche, Paris.

Germany: Gesamtverband Kunststoff Verarbeitende Industrie, E.V., Karlstrasse 21, Frankfurt am Main.

Kunstofferzeungende Industrie un Verwandte Gebieta E.V., Karlstrasse 21, Frankfurt am Main.

Deutsches Kunststoss-Institut, Str. 6, Darmstadt-Schlossgarten.

Holland: The Plastics Institute T. N. O., Julianalaan 134, Delft.

Hong Kong: China Manufacturer's Union, 206 China Building, Hong Kong.

India: The All India Plastics Manufacturers' Assn., Jehangir Building, Mahatma Gandhi Rd., Bombay.

Italy: Associazone Materie Plastiche, Via Massens, Turin.

Instituto Italiano dei Plastics, Galleria Passarella 1, Milan.

Japan: Japan Plastics Industry Assn., No. 43-chome Kasumigaseki Chiyoda-ku, Tokyo.

Mexico: Camara Nacional de la Industria de Transformacion—Secion de los Fabricantes de Materias Plasticas, Plaza de la Republica #6, Mexico City.

Norway: Norsk Plastforening, Radhusgaten 25111, Oslo.

Spain: Centro Espanol de Plasticos, Paseo de Gracia 25, Barcelona.

Sweden: Svenska Plast Foreningen, Karlavagen 43, Stockholm.

Switzerland: Verband Schweizerischer Gummi & Thermoplast Industrieller, Mythenquai 28, Zurich.

Verband Schweizerischer Kunstharz Presswerke, Marktgasse 37, Bern.

Union of South Africa: Plastics Manufacturers' Assn., P. O. Box 1338, Johannesburg.

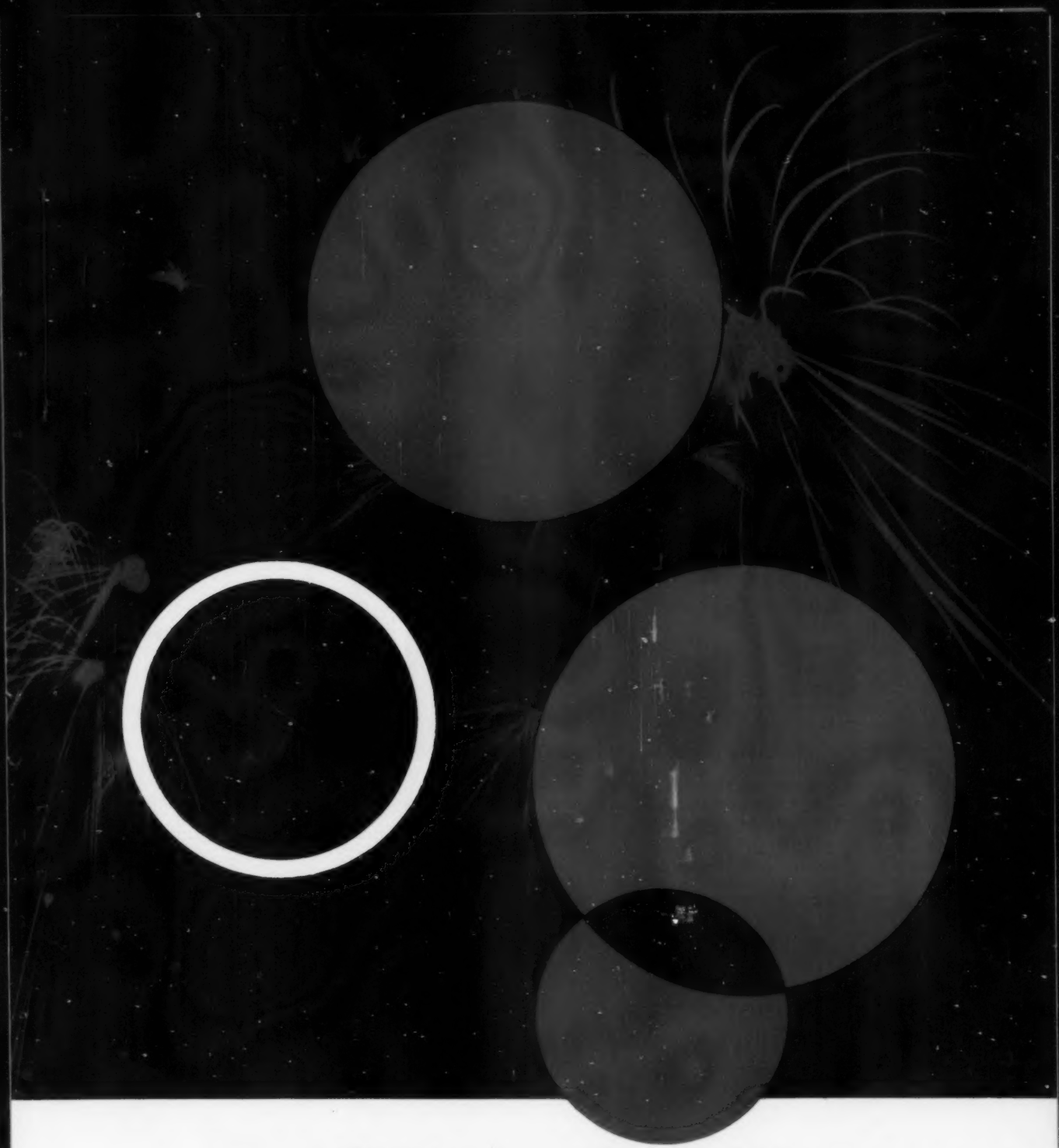
United States: Society of the Plastics Industry Inc., 250 Park Ave., New York 17, N. Y.

The Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.

Western Plastics Industry Assn., 8949 Reseda Bldg., Northridge, Los Angeles, Calif.

Uruguay: Union Industrial Uruguaya, Treinta y Tres #1325, Montevideo.

Venezuela: Asociacion Nacional de Comerciantes y Industriales, Castan e Palmita, Caracas.—**End**



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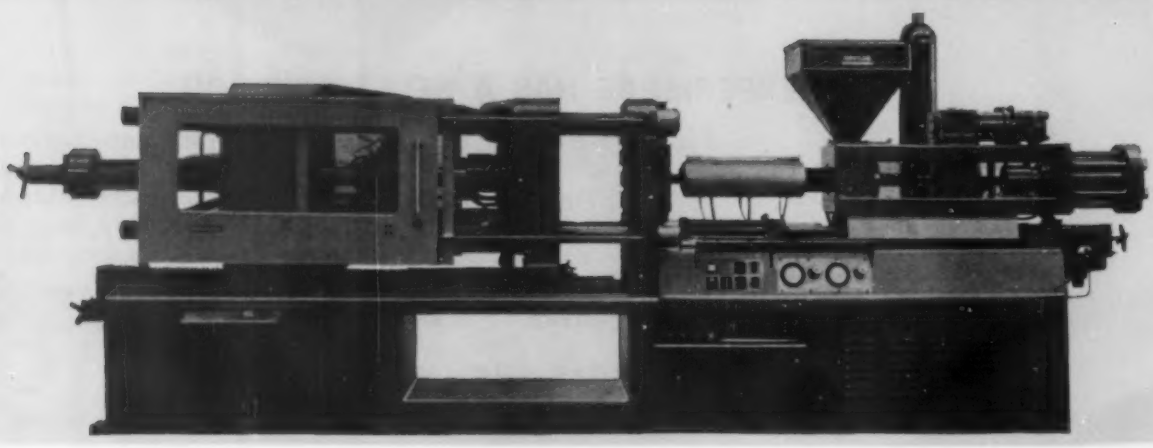

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Tentative Program of Convention

Monday, June 26

Polyolefins—Part I. *"Technical Developments in Olefin Polymers,"* by H. C. Raine, Research Director, Plastics Div., Imperial Chemical Industries Ltd., United Kingdom.

Polyolefins—Part II. *"High Density Polythene and Polypropylene in Europe,"* by Gerd H. Bausback, Mgr., Plastics Sales Division, Farbwerke Hoechst A. G., Germany.

"World End-Use and Output Trends in Polyolefins," by W. A. Woodcock, Vice President, Union Carbide International Co., United States.

Tuesday, June 27

Vinyls. *"Technical Advances in Vinyl Polymers,"* by J. J. P. Staudinger, Technical Director, Distillers Plastics Group, United Kingdom.

"Commercial Trends in Vinyl Usage." Speaker to be named.

Polystyrenes. *"Technical Progress in Styrene Polymers and Copolymers,"* by Gordon Thayer, Research Director, Dow Chemical (Italy), and Freeman R. Lehman, Plastics Sales Supervisor, Dow Chemical Co. (United Kingdom) Ltd.

"Polystyrene in the 1960's," by V. Norman Luke, Commercial Manager, Plastics and Rubbers Division, Shell Chemical Co. Ltd., United Kingdom.

Wednesday, June 28

Processing Thermoplastics. *"Developments in Single-Screw Injection Moulding,"* by A. Kleine-Albers, Head of the Technological Dept., Ankerwerk Gebr. Goller, Germany.

"Bottle Blowing Techniques," by J. F. E. Adams, Senior Project Engineer (Moulded Products), The Metal Box Co. Ltd., United Kingdom.

"The Present State and Development of Equipment for Extrusion," by Gerhard P. M. Schenkel, Chief of Development, Paul Troester Maschinenfabrik, Germany.

"Current Advances in Film Manufacturing Equipment," by David Grant, Technical Director, Bone Brothers Ltd., United Kingdom.

London Meeting on Education and Training

Immediately prior to the Interplas show in London, which begins June 21, the British Plastics Institute has planned an international conference on plastics education and training. It will take place at the Institute of Electrical Engineers, Savoy Place, London WC 2, England on June 19 and 20. Discussion leaders are: A. A. Part, C.B., M.B.E., Deputy Secretary, Ministry of Education; G. Tolley, M.SC., PH.D., F.R.I.C., Chairman of Council, the Plastics Institute; M. Kaufman, B.SC., F.R.I.C., A.P.I., Senior Lecturer, National College of Rubber Technology, London; Professor Bryce Maxwell, School of Engineering, Princeton University, U.S.A.; Dr. R. Tunteler, Plastics Institute T.N.O., Delft, Holland; Prof. Dr.-Ing. A. H. Henning, Director, Institut für Kunststoffverarbeitung, Aachen, W. Germany; Prof. N. I. Basov, Dean of the Faculty, Institute of Chemical Machine Construction, Moscow, U.S.S.R.

Admission will be by ticket only, with a registration fee of £1. Inquiries should be addressed to the Secretary of the Plastics Institute, 6 Mandeville Place, London W.1, England.

LIST OF EXHIBITORS

Floor Plan of Exhibits

Readers interested in obtaining in advance a floor plan of the exhibit halls of the Interplas show, may secure same by communicating with either of the following: Mr. Derek Page, Interplas, Dorset House, Stamford Street, London, S.E.1, England; or Mr. Howard Williams, MODERN PLASTICS, 110 Fleet St., London, E. C. 4. Note: The following list is subject to changes following this magazine's press deadline.

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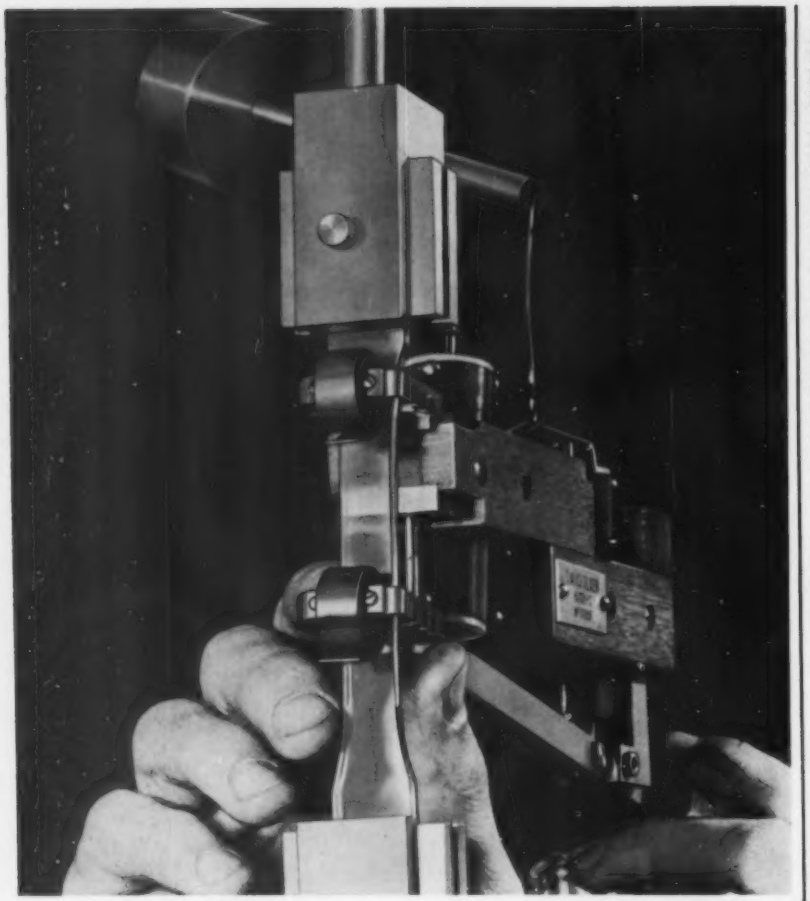

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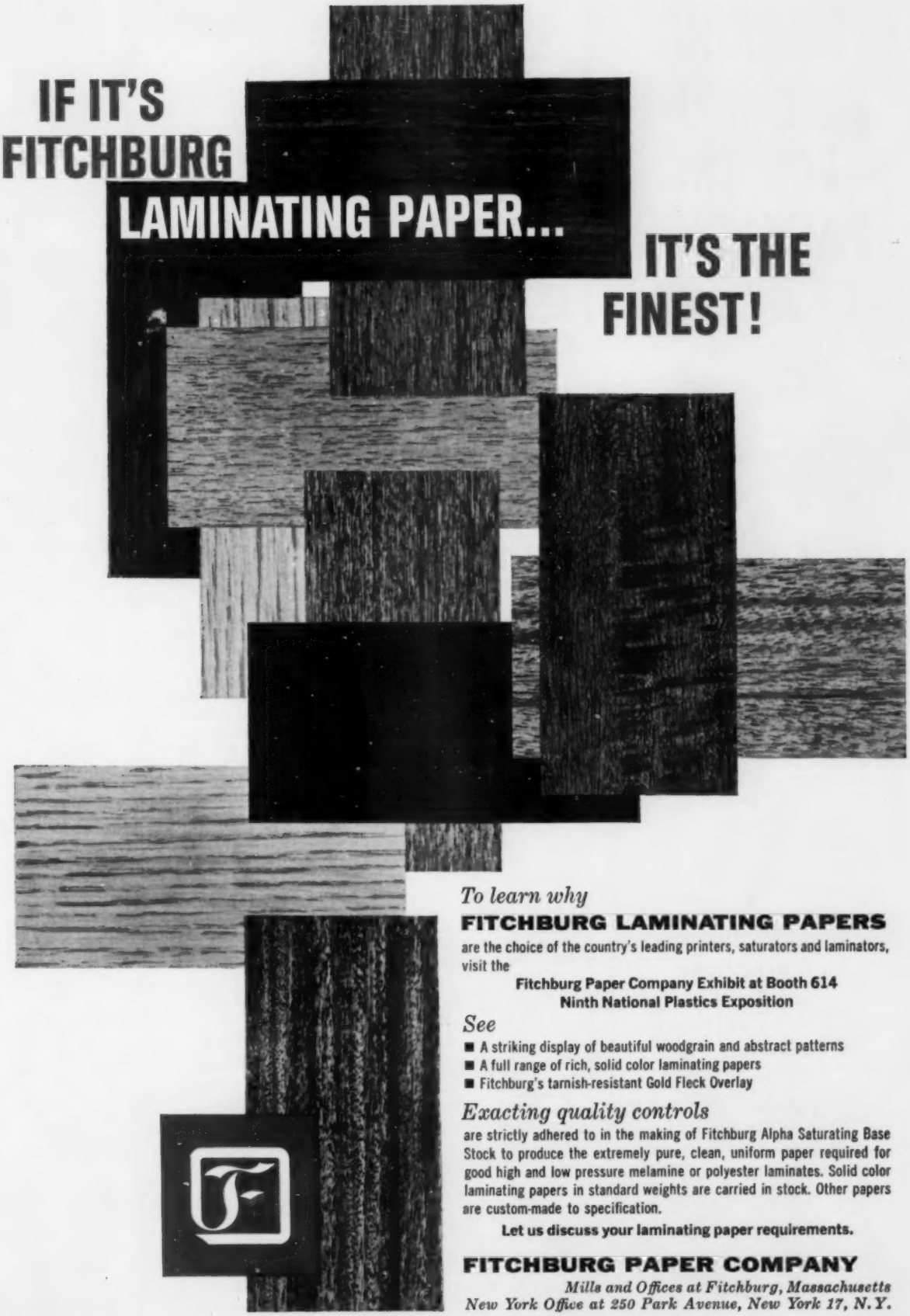

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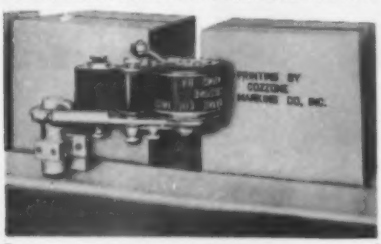

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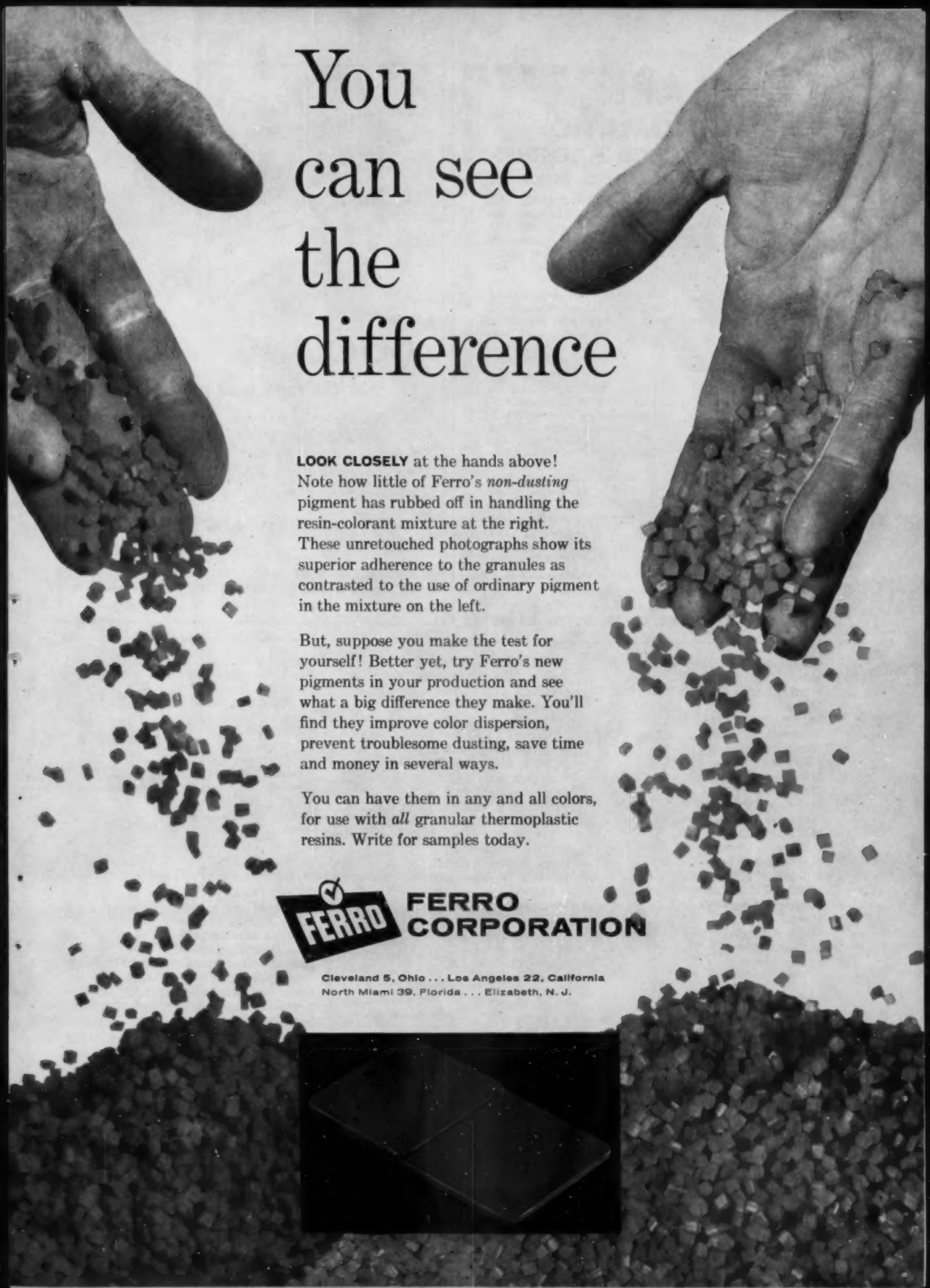
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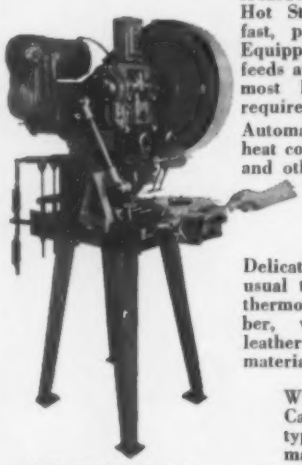

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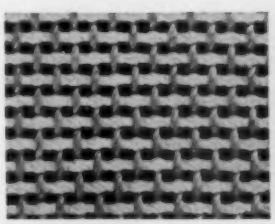

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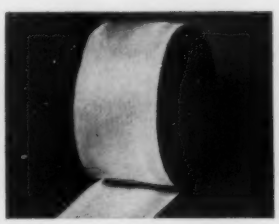

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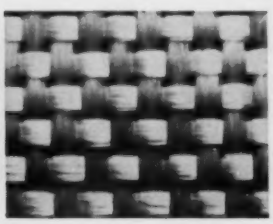

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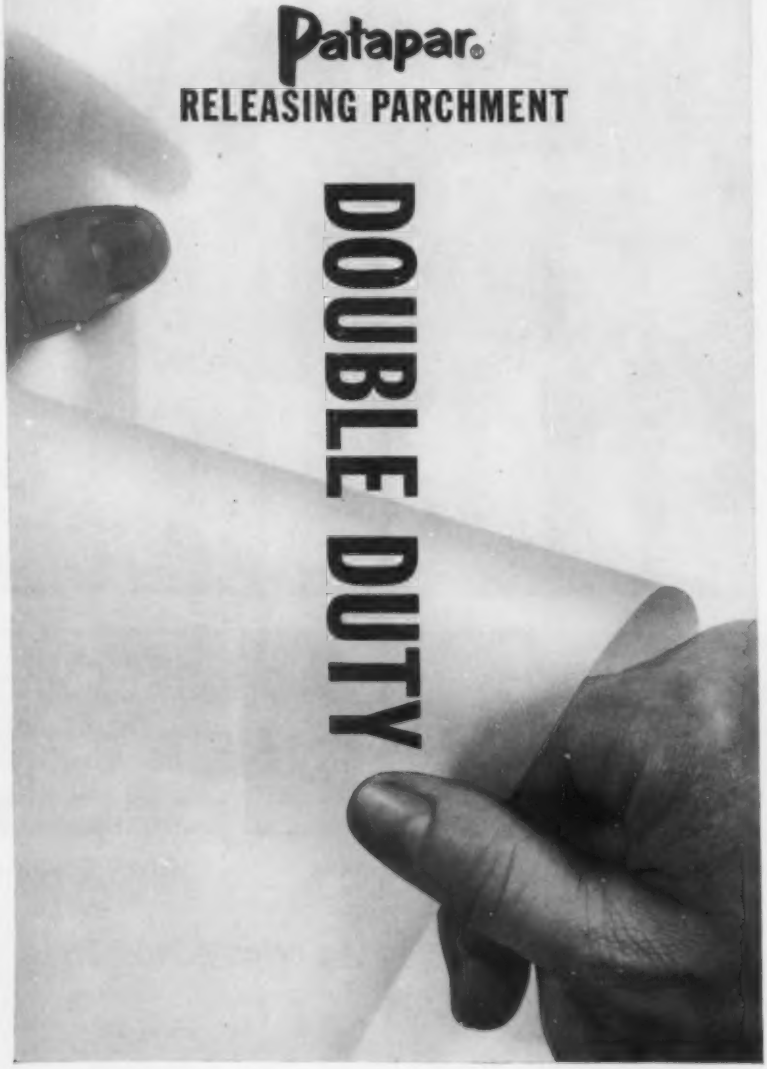

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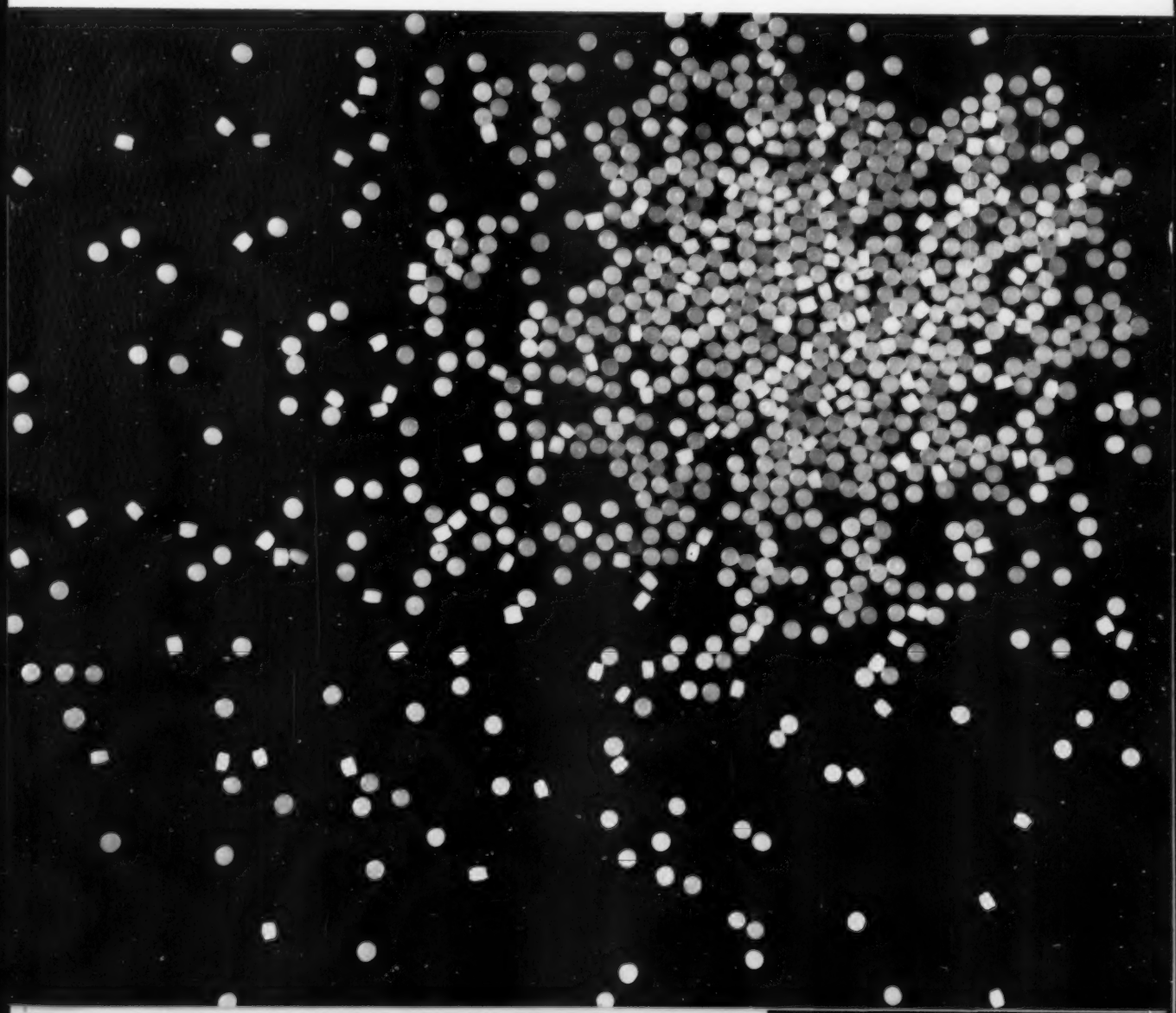

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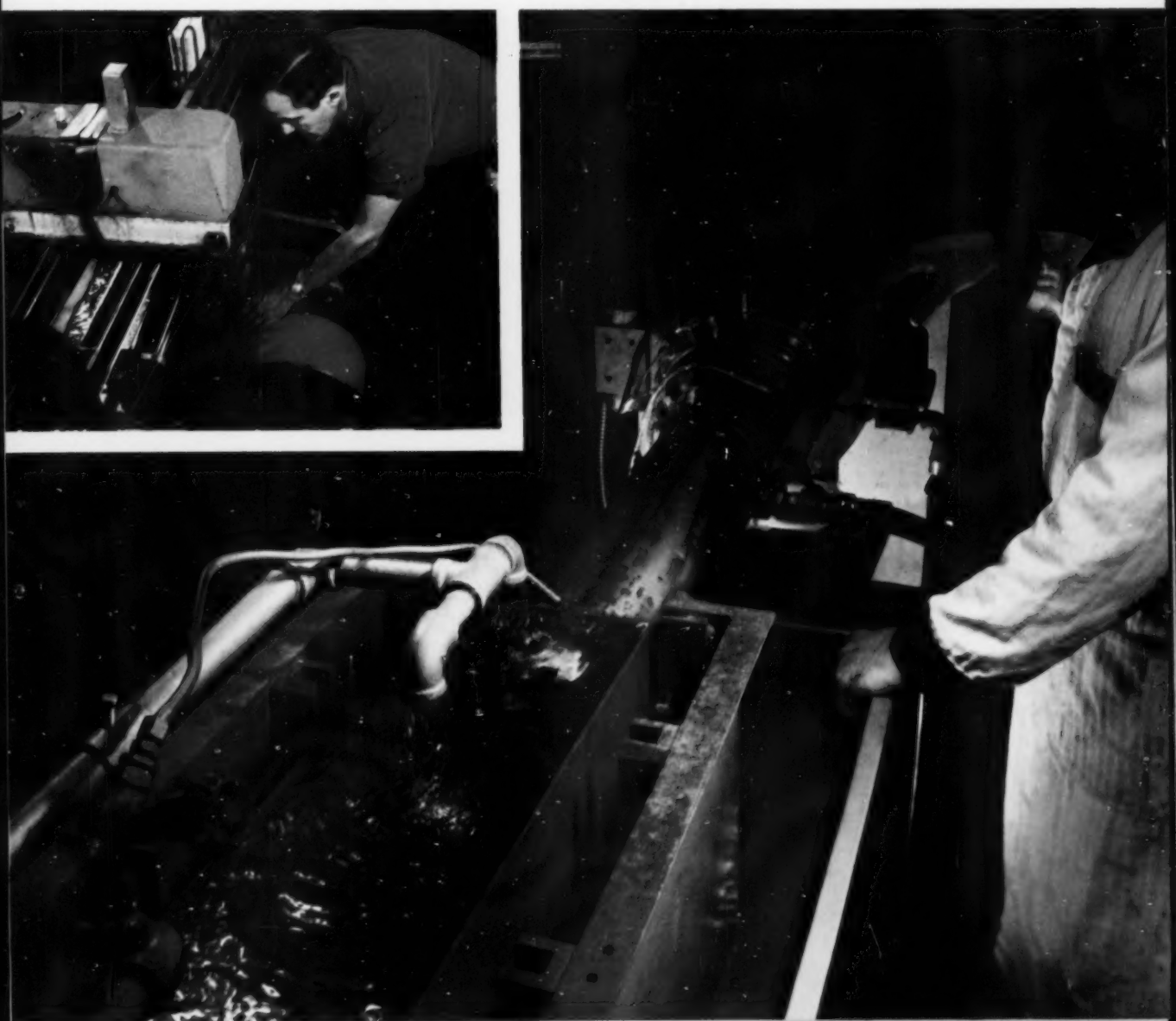

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Melt Index (condition E)	g/10 min	D1238-57T	0.1-0.2	0.04-0.08	0.001
Flow Index (a) (condition F)	g/10 min	D1238-57T	24.0-28.0	8.5-9.3	4.0-5.6
Intrinsic Viscosity	———	D1601-58T	2.3-3.0	3.1-3.7	3.8-4.8
Vicat Softening Temperature	°C	D1525-58T	119	121	122
Ultimate Tensile Strength, 20 ipm	psi	D412-51T	2250	2450	2700
Tensile at Yield, 20 ipm	psi	D412-51T	3450	3450	3450
Elongation, 20 ipm	%	D412-51T	120	320	560
Impact Strength (b)					
⅛ x ½ bar	ft/lbs in notch	D256-54T	19	31	36
¼ x ½ bar	"	D256-54T	8	17	24
½ x ½ bar	"	D256-54T	0.9	1.9	4.3
Stiffness in Flexure	psi	D747-50	115,000	115,000	120,000
Hardness	Shore D	D1706-59T	60	60	60
Environmental Property					
Environmental Stress Cracking (c)					
With Anti-oxidant	hrs.		65	445	>800
Without Anti-oxidant	hrs.	D1693-59T	40	230	500
Thermal Embrittlement (d)					
With Anti-oxidant	hrs.	(d)	185	>1000	>1000
Without Anti-oxidant	hrs.	(d)	70	95	700

(a) Cutoff on flow index test made at the end of 30 seconds.
(b) The impact strength test result is greatly influenced by sample size.
(c) ASTM Standard on Plastics, D1693-59T Method of Test for Environmental Stress Cracking of Type I Ethylene Plastics. This test, which has been adopted for Type I Ethylene Plastics is used herein for Type III in the absence of an official method.
(d) This test employs compression molded specimens, 5" x 0.25" x 0.05", three of which are wrapped and clamped around a ¼" mandrel. The apparatus is inserted in a nitrogen blanketed test tube which in turn is placed in an aluminum block @ 100°C. The value reported is the time until two of the three samples crack.

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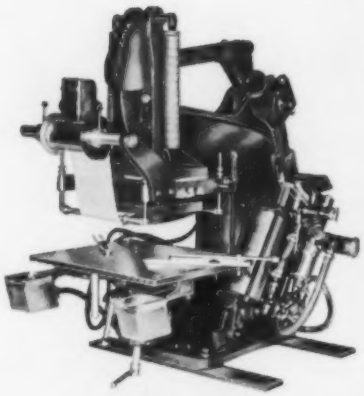

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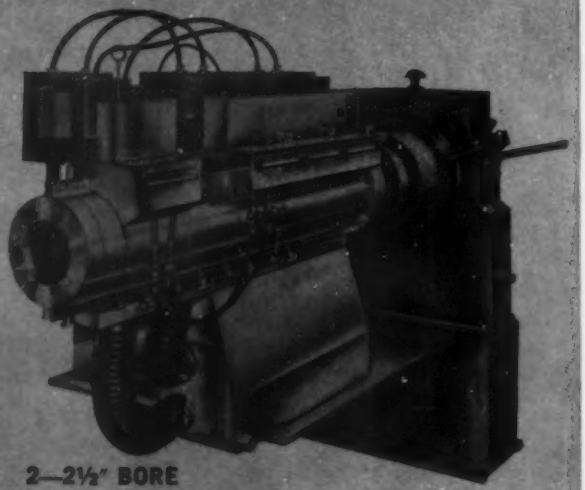

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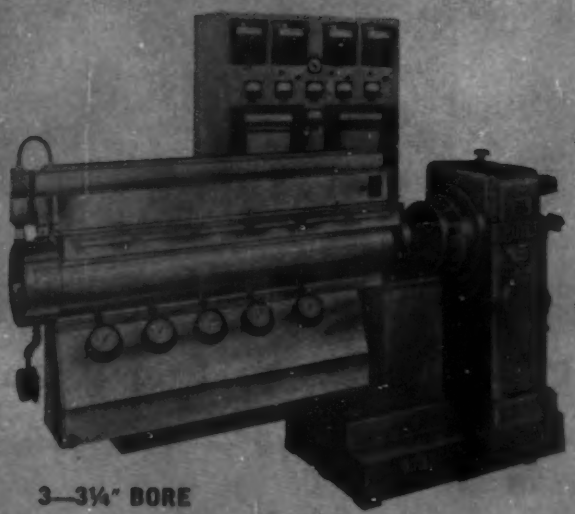

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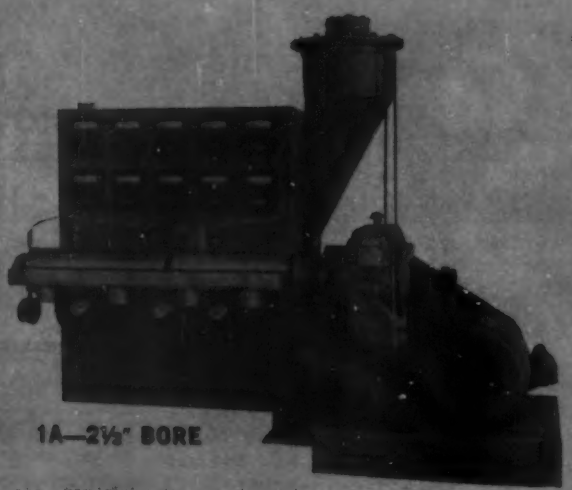

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Guide to corona film treatment

How design of the electrodes and the nature of the electrical input affects the treatment of polyethylene film

By J. C. von der Heide† and H. L. Wilson‡

In the early 1950's when polyethylene's packaging potential was first recognized, it became desirable to print the surface similar to printing on other packaging materials. However, it was soon discovered that the inert nature of polyethylene also rendered it unreceptive to printing inks, and a search began for a means of altering the surface properties of polyethylene to make it receptive to these inks.

Generally, three approaches were taken. The first was the use of special inks. Successful formulations were similar chemically to polyethylene. These softened or dissolved the surface so the inks could fuse into the surface. But cost for these operations became prohibitive.

The second approach was chemical treatment of the surface to make it receptive to polar inks. Combinations of chemicals were tried which would oxidize the film surface. These treatments, similar to the oxidation processes used to bond polyethylene to metals, were, for the most part, unsuccessful.

The third approach was the physical treatment of the polyethylene surface. Some of the methods tried were: 1) heating one surface to a high temperature while holding the other at a low temperature (1)[1]; 2) contacting the film surface with a highly oxidizing flame (2) (which is in somewhat limited use today); and 3) electron bombardment. Out of electron bombardment investigations came tests with Tesla coils and ozone (3) which led to what is today called electronic treating or, more specifically, corona-discharge treating. Physical treatment, then, generally implies the use of physical means, as distinguished from chemical, in altering the film surface.

It was noted that apparently the film surface had to be made polar. Theories were advanced, some of which lost sight of the problem in their complexity and had the effect of leading the industry astray. Corona treating is today the most widely used treating method but, unfortunately, has become one of the most confusing devices the converter has in his shop. In an effort to clarify the subject, a study into the basic mechanisms of corona treating was carried out in the Polymer Service Laboratories of the U. S. Industrial Chemicals Co. This article is one result that evolved from that study.

There is no doubt that when corona treaters are used the film surface is altered, making it receptive to ink. Whether or not this is actual oxidation (4, 5), or what physically or chemically takes place, will not be discussed here. Our purpose is to discuss the mechanism of corona treating.

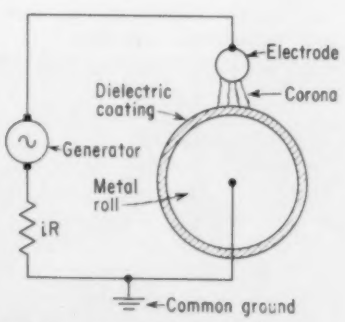

FIG. 1: Schematic of electrical discharge film treating machine. Corona discharge is struck between electrode and polyester dielectric coated take-off roll, which is connected at the ground potential to the opposite side of the alternating voltage generator.

Present methods of obtaining the corona discharge

Electronic treating requires some device to produce a controllable corona discharge on the film surface. Let us consider, for the moment, some of the present methods of obtaining the corona discharge. In general, a corona treater consists of a generator, an electrode, a back-up roll (or treater roll), and a dielectric between the electrode and back-up roll, as indicated by Fig. 1, left.

One method, Fig. 2a, p. 200, involves multiple glass-covered electrodes and a treater roll covered with a polyester film (6). Here, there are actually two dielectrics—one is the glass, and the second is the polyester. The corona occurs between the electrode and the polyester or film surface. Multiple electrodes are required in order to obtain the desired quantity and uniformity of discharge. The electrodes run the width of the treater roll, which usually does not coin-

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‡ Director, Polymer Service Laboratories, U. S. Industrial Chemicals Co., Div. of National Distillers & Chemical Corp., Tuscola, Ill.

Adapted from a Presentation at Plastteknik 1960-Technical Conference of the Swedish Plastic Federation.

[1] Numbers in parentheses designate references at end of article, p. 344.

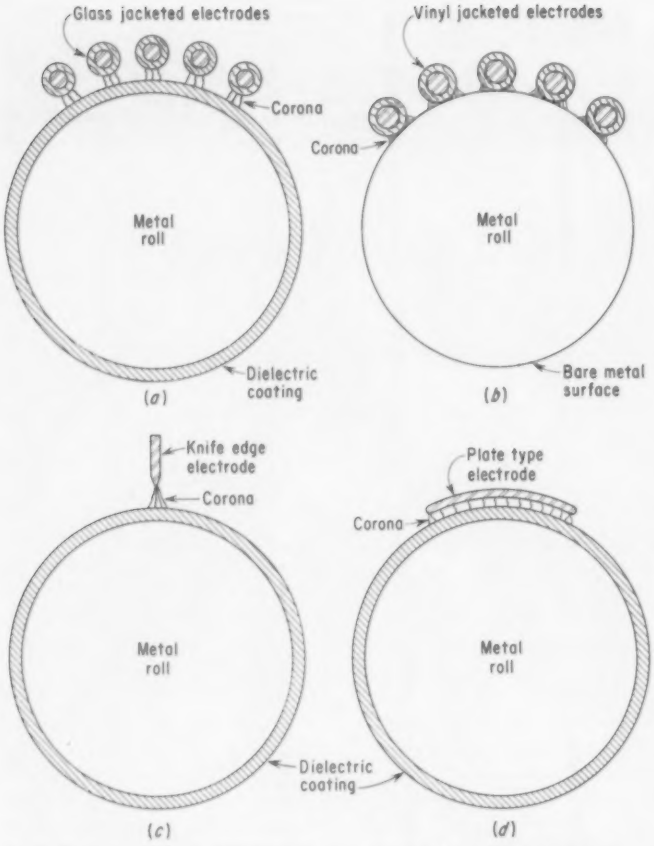

FIG. 2: Four different electrode designs. *(a)*—Glass jacketed metallic electrodes used in multiples with polyester dielectric coated roll; *(b)* —Vinyl jacketed electrodes used in multiples with uncoated metal roll (electrodes contact film being treated); *(c)*—Unjacketed metal knife-edge electrode used with polyester dielectric coated roll; *(d)*—Shoe or plate type electrode used with coated metallic take-off roll.

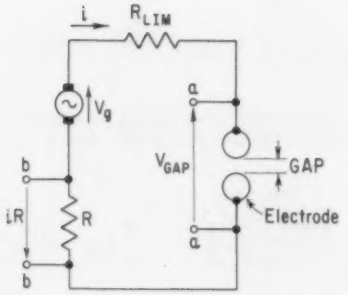

FIG. 3: Circuit of experimental oscilloscope studies used to determine relationships between gap voltage, current, voltage and current wave forms, and gap size. Terminals a-a were connected to one channel of the oscilloscope to observe the voltage wave form. Terminals b-b were connected to a second channel to observe the current through R.

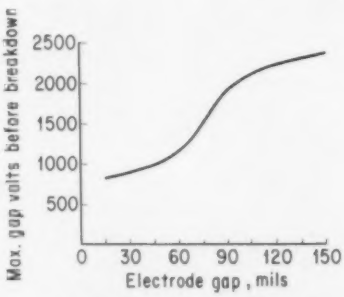

FIG. 4: Graph showing the maximum voltage which can be impressed between electrodes corresponding to the gap between the electrodes. The electrode gap voltage shown above is that just below the point where corona discharge takes place.

cide with the width of film to be treated. Treater roll diameter is in the order of 12 to 16 inches. One of the major drawbacks of this treater design is breakage of the glass covered electrodes.

A second method—see Fig. 2b —involves multiple vinyl-covered electrodes, but no covering on the treater roll (7). The vinyl-covered electrodes are actually in contact with the film surface being treated. Corona occurs between the electrode and film or roll surface at points just before and after contact. Multiple electrodes are required in order to obtain a sufficient quantity of corona. The electrodes run the width of the treater roll; treater roll diameter is on order of 16 inches. The generator produces a sine-wave type of voltage at a frequency of about 800-1000 c.p.s. with high harmonic content. Among the major drawbacks of this system are wrinkle problems at thread up, and maintaining electrode alignment.

And a third method, Fig. 2c, involves a single bare knife-edge electrode, and a polyester film-covered treater roll (8). The electrode is spaced from 0.03 to 0.09 in. from the treater roll, and corona occurs between the electrode and the polyester or film surface. The electrode length generally is cut to the width to be treated, which is actually an advantage in that the polyester which is unprotected by the film does not break down prematurely. Generally, only one electrode is required; but, where a more severe treatment is needed, two or more electrodes can be paralleled. Treater roll diameter is on the order of 4 to 6 inches. The generator is a sine-wave type at a frequency of about 2700 c.p.s. An advantage of this system is that the electrode is usually pivoted at one end and can be swung away for threading the film. A disadvantage is the audible sympathetic vibration of the electrode.

A fourth method, as shown by Fig. 2d, involves a shoe-type electrode and a polyester-covered treater roll (9). The electrode is spaced from 0.06 to 0.12 in. from the treater roll, and corona occurs between the electrode surface and the polyester or film surface. This electrode length is also generally cut to the treated width. The width

of the shoe depends on the severity of treat required. Treater roll diameter is on the order of 4 to 6 inches. The generator is a random noise device, with a 60-c.p.s., or line frequency, fundamental, and random impulses occurring at approximately 5×10^5 pulses per second. Corona is random over the surface of the shoe. The electrode can be lifted, but not swung, from the roll.

A major disadvantage of this system is the random noise generator. The impulse generator, being of a steep-angle wave form, requires that a great deal of electrode cable insulation be used to prevent shortout to the surroundings. Also, interference with radio reception has been experienced; thus, the system must be completely shielded and grounded.

In order to evaluate and discuss these major methods of corona discharge and treatment, an understanding of corona mechanism is first required.

Corona occurs when air or gas is subjected to a potential gradient sufficiently high to ionize it. When air is ionized, it becomes a conductor capable of carrying current.

To illustrate the mechanism of corona, two electrodes were set up so that gap voltage, electrode current, and wave forms could be observed, and a record taken of gap voltage vs. current with varying gap dimension. This set-up is shown in Fig. 3, p. 200. Generator voltage was increased from zero and gap voltage at the ignition point, then gap voltage vs. current were recorded at various gap dimensions. The results are shown in Fig. 4, p. 200, and Fig. 5, above. A sine-wave voltage was used, and all measurements were taken with a Tektronix 533 oscilloscope—peak value recorded. Note that there is a sharp rise in firing voltage above 0.06-in. gap, as shown in Fig. 4, and that the 0.06- and 0.09-in. gap voltage vs. current plots in Fig. 5 are almost level.

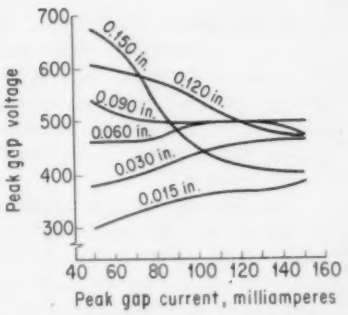

FIG. 5: Relationship between the peak corona discharge voltage and current for various gap sizes. Peak values represent maximum amplitude of the alternating voltage and wave forms.

Fig. 6, below, is an oscillograph of the gap voltage and current wave forms, and serves well to illustrate the "Thyratron principle" involved in the corona discharge. Gap voltage rises with generator voltage, V_g, until the ignition, or air ionization, point, then drops to a low value over the remainder of the half-cycle, repeating this procedure on the negative half-cycle. Current rises sharply at the firing point, which is limited by the impedance of the circuit.

Now consider Fig. 7, below, where two sets of electrodes, *A* and *B*, are in parallel, but at different distances from the mating electrodes. In the first case, switch S_1 is open and S_2 and S_3 are closed, shorting the resistors R_A and R_B. As gap voltage is increased, the electrode pair *"A"* will fire, first-distance at *"A"* being less than distance at *"B."* Since the gap voltage then drops to a very low value, the electrode pair at *"B"* will never fire. If, however, S_1 is closed shorting R_{LIM} and S_2 and S_3 are opened, placing R_A and R_B in the circuit, the electrode pairs are isolated from one another by the bridge-out resistors R_A and R_B, and both *A* and *B* will fire at their respective firing potentials based on the gap dimension. From the foregoing, it can be seen that a dielectric covering over one electrode has the same function as the bridge-out resistors are *A* and *B*. The dielectric spreads the discharge along length of the electrode, and it makes little difference as to which electrode is covered. If it were not for the dielectric, the discharge would occur at only one point—the point closest to contact with the roll.

Fig. 1 is the generally accepted form of the corona-discharge type

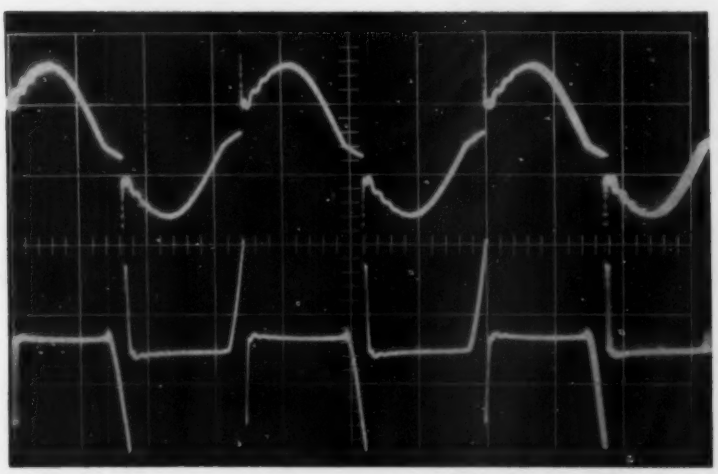

FIG. 6: Oscilloscope traces showing gap voltage (lower trace) and current (upper trace) wave forms in the corona discharge machine.

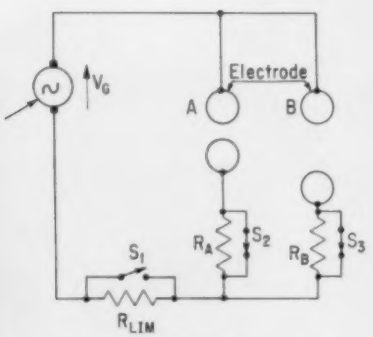

FIG. 7: Circuit used to demonstrate effect of placing a dielectric material on electrodes with different gap sizes. With S_1 closed and S_2 and S_3 open, circuit acts like electrodes used with dielectric; R_A and R_B simulating action of the dielectric.

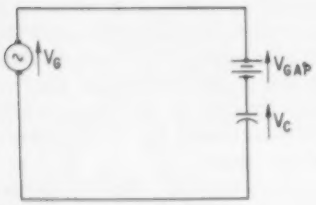

FIG. 8: Schematic or equivalent circuit of the corona treater. Generator's voltage is v_g, while v_{gap} refers to the voltage drop in the corona discharge, and v_c represents the voltage drop across the dielectric.

electronic treater. Observation of this device in operation shows that the total discharge is made up of several "needles" which are spaced over the electrode surface, the spacing depending upon the electrode-to-roll distance.

The dielectric, then, is required to spread the corona along the length of the electrode. Again consider Fig. 1 and assume that the dielectric is now the polyethylene to be treated. All the physical requirements for corona treatment are met, and the system should and will operate—until a pinhole or other film defect appears. The treater will then function as a pinhole detector and funnel the entire discharge through the hole to the roll. In reality, the concentrated discharge will burn the pinhole to a sizable dimension. Since our object is to treat, and not to detect film flaws, there is a need for a buffer dielectric to prevent burn-through in the event of a pinhole. Therefore, most treating systems currently use a polyester covering on the treater roll to serve as a buffer dielectric.

Let us again consider the two-sphere electrode pair of Fig. 3. When corona occurs, operation is very similar to that of an arc welder or arc lamp. With generator voltage held constant, decreasing gap leads to increased current and a hotter arc. Also, with gap dimension fixed, increased current produces more corona in that additional air must become ionized to carry the increase in current. But treating action depends upon the amount and intensity of corona that comes in contact with the film surface. Consider first that, if one electrode were but an infinitesimal distance from the other, corona could be established at a given current and the electrode voltage would be low. Now, consider what would happen if the one electrode were moved to an infinite distance from the other.

Corona could be maintained at the given current, but at an electrode voltage which would also be infinite. The electrode-to-roll distance, therefore, should be of a value which permits the maximum corona width at a minimum height. Experimentation has shown this to be on the order of 0.06 inches. As an aside, it has been found that if a film converter complains of an excess of ozone, his electrode-to-roll distance is usually too great.

Of further importance is that the electrode-to-roll distance should be constant along its length in order

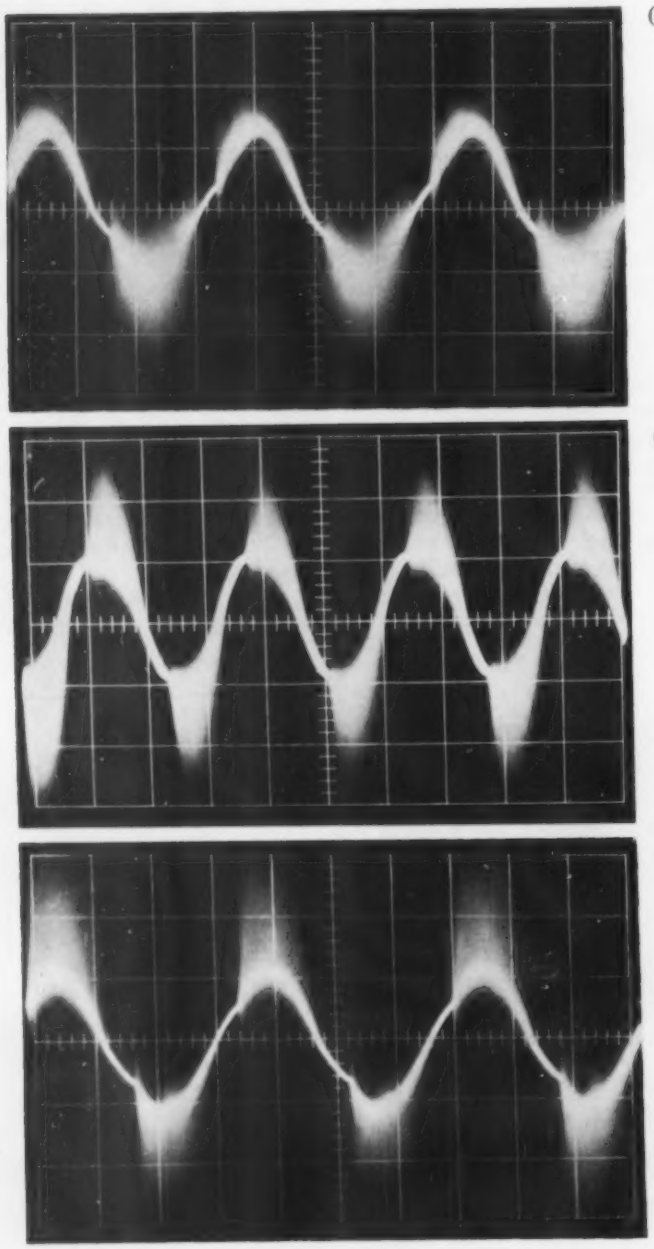

FIG. 9: Oscilloscopes of the electrode current during corona discharge. using different electrode designs. *(a)*—Knife edge type of electrode; *(b)*—Cylindrical surface type electrode; *(c)*—Threaded stud or rod type of electrode. Abscissa of curves is time.

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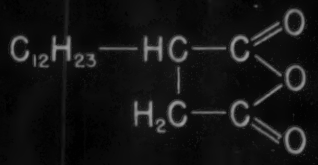

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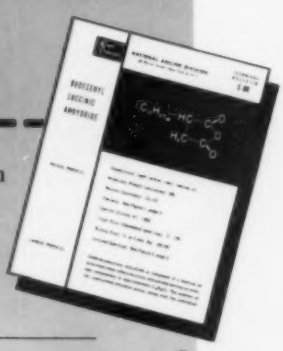

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to generate equal corona and ultimately to yield uniform treat on the film.

Corona as related to treating action

Perhaps the most difficult value to decide in a corona treater is the thickness of the buffer dielectric, the purpose of which is only to prevent burn-through in case of a pinhole. Experimentation has shown us that thicknesses of polyester film from 0.002 to 0.024 in. will all burn up in a few minutes at the same corona current.

Consider, then, Fig. 8, p. 202, which is a schematic representation of a corona treater. V_G is generator output voltage, V_{GAP} is the relatively small and fixed voltage drop of the corona discharge, and V_D is the voltage drop across the dielectric—usually the polyethylene and polyester combination. Öhm's law for a capacitor (dielectric) is

$$e = \frac{1}{C} \int i \cdot dt \qquad \text{Eq. 1}$$

or differentiating both sides,

$$\frac{de}{dt} = \frac{1}{C} \cdot i \qquad \text{Eq. 2}$$

where: e is voltage, i is current, and C is capacitance. This shows that the voltage drop across the buffer depends upon wave form, current, and the capacitance of the buffer. The capacitance of the buffer decreases as its thickness is increased; and, therefore, the voltage drop across the buffer increases accordingly. This item is discussed in most text books dealing with electric fields or transmission lines, and is expressed by an equation of the form:

$$C = \frac{K}{\log_{10} \frac{D}{r}} \qquad \text{Eq. 3}$$

where: C is capacitance, K is a constant, D is distance between conductors, and r is the radius of the conductor. Since the generator has a certain maximum voltage output, it becomes evident that the current, and thus corona and treat, will be limited for the most part by the quantity of the buffer. The thickness of the buffer, then, should be of sufficient value to prevent burn-through, but not so large as to seriously limit the current carrying capabilities of the system. Experimentation has suggested a value of polyester thickness on the order of 0.006 inch. Life of the buffer depends upon the potential gradient across it, which is governed by the desired corona current. As can be seen from Eq. 3, D, which in this case is the thickness of dielectric, can be reduced; or r, which ultimately leads to the surface area over which corona occurs, can be increased to increase C and, thus, reduce the potential gradient across the dielectric, thereby increasing its life.

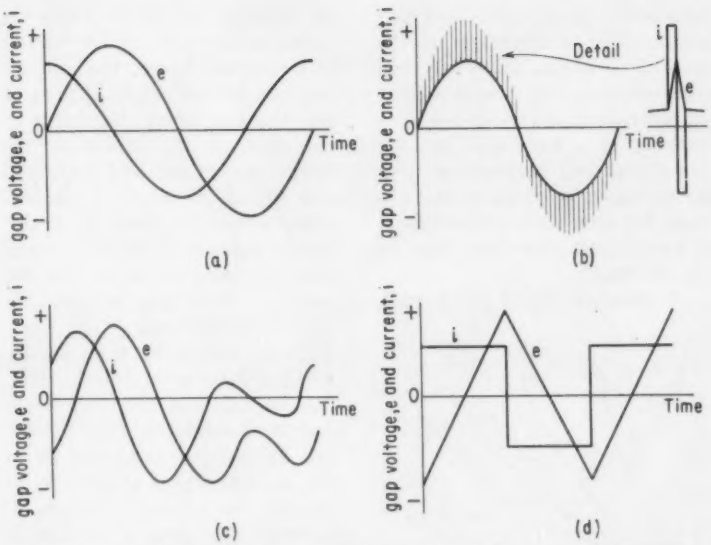

FIG. 10: Gap voltage and current wave forms using different types of generator inputs. *(a)*—Sinusoidal voltage input; *(b)*—Random pulse with steep angle wave fronts; *(c)*—Sinusoidal input with high harmonic content; *(d)*—Symmetrical saw tooth voltage input.

Another item is heat. Since the corona discharge is hot, buffer film life will also be influenced by its heat resistance. Of the buffer dielectrics used in corona treaters, polyester, polyethylene, vinyl, etc., none are indestructable and will have to be replaced eventually.

From the oscillograph of Fig. 6, it can be seen that measuring voltage and current can be done accurately only with an oscilloscope—D'Arsonval movements will indicate only average values. A D'Arsonval movement can be used as a substitute for production, but values will only be relative to the given system and be of value only in re-establishing conditions. Of more benefit is an ammeter to measure average electrode current.

It was desired to observe the current wave forms of the existing knife-edge and cylindrical-surface electrodes in operation. A sine-wave generator was used.

Fig. 9a, p. 202, is an oscillograph of the electrode current using the knife-edge electrode. Observe that the negative is much greater than the positive discharge portion; the negative portion corresponding to the electrode being negative with respect to the base or roll. The corona needles line up somewhat uniformly along the knife-edge. Fig. 9b is an oscillograph of the electrode current using the cylindrical-surface type electrode. The positive and negative discharge portions are equal; but corona occurs in an avalanche, is difficult to control, and discharge needles are randomly spaced along the electrode surface.

Uniformity of film treatment is dependent upon corona uniformity, both down and across the electrode. Since the object of the electrode is to provide a means whereby corona can occur, a design which will aid in this objective is certainly of benefit. Because of electron density, a pin-point (such as the lightning arrestor) will initiate a corona discharge more readily than will a flat surface, the pin-point being negative with respect to its mating electrode. The flat surface, on the other hand, sus-

tains nearly equal positive and negative half-cycle discharges at the sacrifice of corona uniformity and controllability. This would suggest an electrode design which is a combination of a knife-edge and flat (or cylindrical) surface—say pinpoints regularly spaced on the surface. But after some consideration, it was thought that there must be an alternative.

A standard 5/16-18 N.C. stud, or threaded rod, of a length required by the width of the film to be treated was tested. The stud not only provided a uniform spacing of the discharge along the length of the electrode, by reason of the thread spacing and lead angle, but also spread the width of the discharge across the electrode. A side benefit was realized in that the stud does not have anywhere near the tendency to vibrate as does the knife-edge electrode.

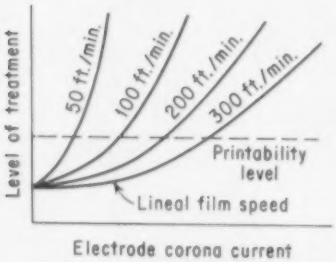

FIG. 11: Chart showing the form of variation of the level of treatment required to reach a printable level at various film speeds. A higher level of electrode corona current is required as film speed increases to produce a printable PE film surface.

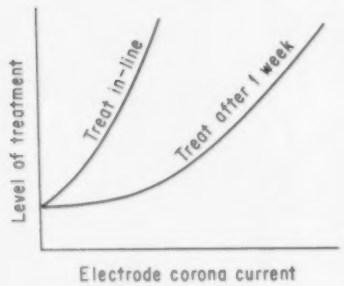

FIG. 12: Effect of the aging of the extruded film on the electrode corona current required to reach a given level of film treatment.

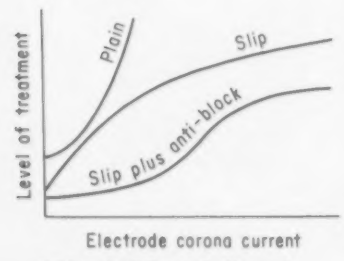

FIG. 13: Effect of slip and anti-block agents in the film material on the electrode corona required to reach a given level of treatment.

Shown in Fig. 9c, is an oscillograph of the stud electrode current. Observe that with the same amplitude fundamental in Figs. 9a, 9b, and 9c that the stud electrode in Fig. 9c discharges a greater corona current, thus yielding a greater efficiency. The positive portion is slightly less than the negative portion, but certainly not inoperable, as is the case with the knife-edge. Several studs may be cut to various lengths as required by the film width and easily attached to the support bar at will, offering additional process versatility.

A single electrode can be loaded only to a certain maximum value, about 5 ma./in., before the discharge becomes so violent that it is no longer uniform. Should higher current densities be required, two or more electrodes may be placed in parallel, or a larger stud employed — say ½-16 N.F. Of course, this assumes that the capacity of the generating equipment is not exceeded.

A warning is in order: The corona width for the stud is greater than that of the knife-edge. This is desirable in the light of Eq. 3 and buffer life considerations, but one adverse effect occurs as stud diameter increases; the surface temperature of the polyethylene increases to such a high value that the film may burn. Further, if multiple electrodes are used, they should be spaced at least 1 in. apart to allow the polyethylene surface time to cool. Up to the point of burning the film, a single electrode with a large discharge accomplishes the same treat as do multiple electrodes with correspondingly smaller discharges per electrode.

Since treat depends upon corona, which in turn is dependent upon current, electrode current wave form is important in treater action. This is primarily pointed out in Figs. 9a, 9b, and 9c which show the desirability of using a stud electrode. Under consideration now, then, is the resulting current wave form if the generator voltage wave form is changed. Rearrangement of Eq. 2 results in:

$$i = C\frac{de}{dt} \qquad \text{Eq. 4}$$

If generator voltage is sinusoidal, then electrode current is cosinusoidal and is limited by the impedance of the circuit, or simply the capacitance *C* in Eq. 4. (See Fig. 10a, p. 205.) If generator voltage is random pulses having steep-angle wave fronts, then de/dt (and, therefore, *i*) is a series of pulses, each of which could approach infinity, even though the voltage function is bounded (Fig. 10b). Sinusoidal voltages with harmonics lead to current wave forms of generally odd shapes (Fig. 10c). Actually, this is undesirable, in that uniform and constant corona is the objective. The fact that constant current leads to uniform corona, suggests then, that in the "generator of the future," the voltage output wave form should be a symmetrical sawtooth the derivative of which is a square-wave (Fig. 10d).

Effect of treat on printability

Having considered the mechanism of corona treating, a brief discussion on the effect of treat and machine variables on printability is in order. As has been shown, corona depends upon current, more or less of which leads to more or less treat, all else remaining constant. Gap dimension, number of electrodes, etc., affect corona and, therefore, are not machine variables.

The second machine variable is web speed. Assume for the moment that treat can be measured (10 and 11). Fig. 11, above, then, is a graph showing the general effect of speed on printability, which shows simply that increased speed requires increased corona.

For polyethylene with additives, in-line vs. later treatment is a third variable and is shown in Fig. 12, left. The fourth and most unpredictable variable is the resin itself. Here only one statement can be made: Resins with **(To page 344)**

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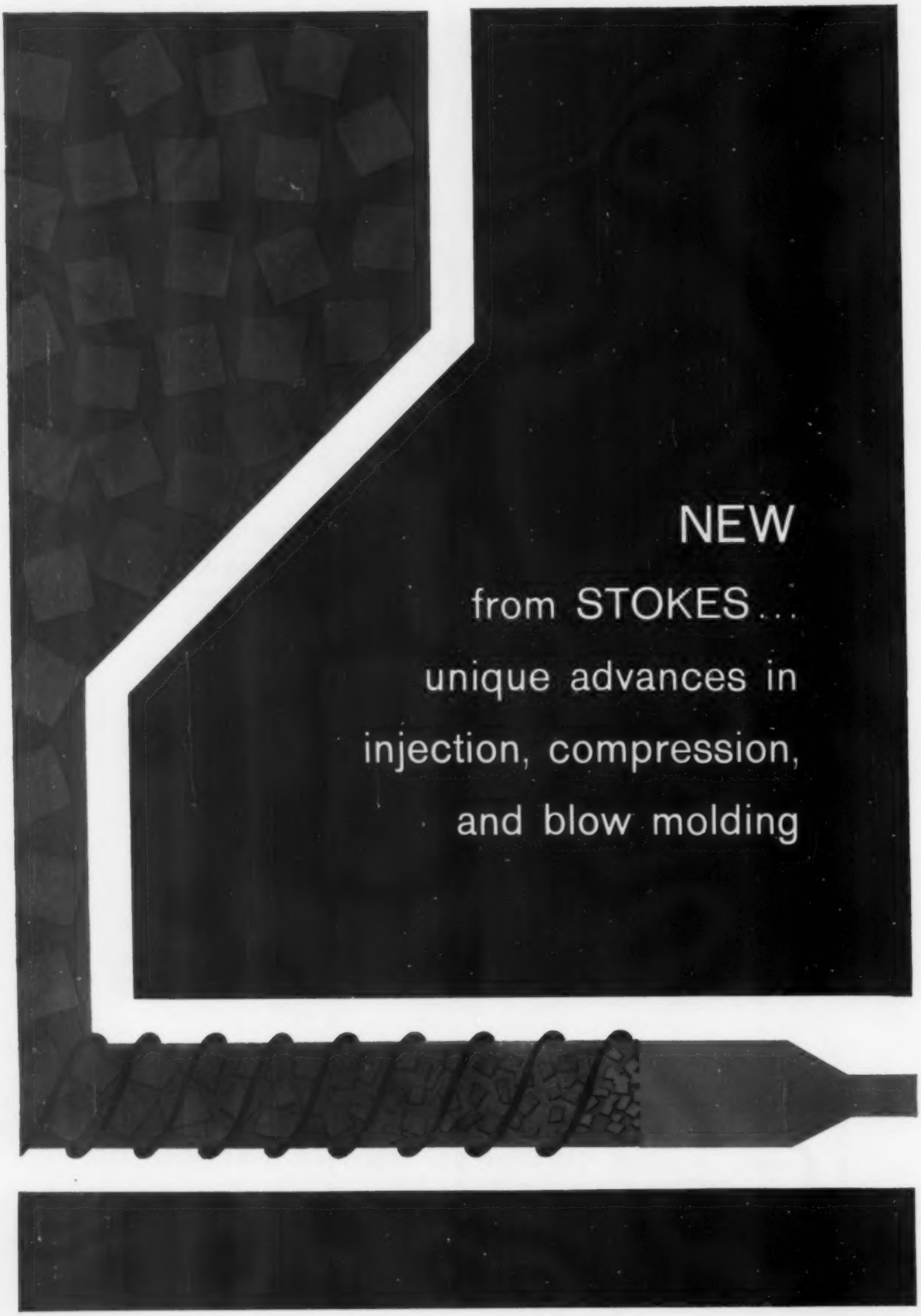
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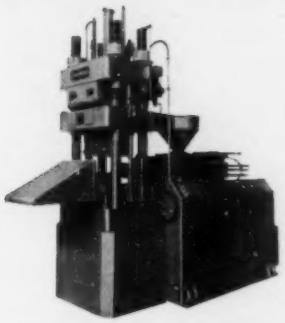

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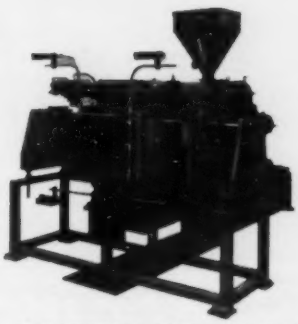
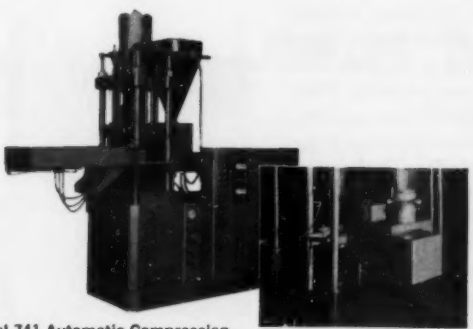


Model 855-2 Blow Molder with extruder



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Advances in dry blend extrusion

By N. T. Flathers*, R. E. Johnson*, V. R. Pallas*, and W. Mayo Smith*

This article presents further developments in the technology of the extrusion of filled and unfilled PVC formulations from dry blends with the aid of a vacuum hopper. It also discusses the use of extremely fine mesh screens, which in conjunction with the vacuum hopper, has made possible the extrusion of clear PVC products of excellent quality. Included are more quantitative data than previously published on the effect of extrusion conditions on porosity, product quality, and rate.

Last year we described the application of the vacuum hopper in the extrusion of a variety of PVC dry blend formulations (1).[1] The effectiveness of the vacuum hopper in eliminating internal porosity and rough surface due to air and moisture in the dry blends was demonstrated with both unplasticized and plasticized compounds, filled and unfilled. This article presents rate studies, quality comparisons, and quantitative porosity data observed in a variety of extrusion conditions with two formulations:

1. A filled formulation for electrical insulation typical of that used in building wire, and

2. A clear formulation similar to what might be used in blown film and various clear profiles.

In PVC dry blend extrusion the use of a resin virtually free of "fisheyes" (gel) is essential. With filled compounds fisheyes appear mainly as surface pimples or blemishes. These fisheyes detract from product appearance and in some cases from product properties, *e.g.*, dielectric strength. In clear material the fisheyes can be seen throughout the entire product. Even with diced compounds what appear to be fisheyes have been observed. It has been shown that these latter imperfections are not due to fisheyes, *i.e.*, individual unfluxed resin particles, but rather to other faults in the extrudate such as pick-off of stock which has adhered to the screw, cylinder, die, etc., or to crosslinking of the polymer by heat and/or oxidation. The use of extremely fine 325-mesh screens results in a flawless product.

*Research Center, Escambia Chemical Corp.
From a paper presented at the S.P.E. 17th Annual Technical Conference in Washington, D. C., Jan. 24-27, 1961.
[1]Numbers in parentheses designate references at end of article, p. 348.

Equipment

To clarify the following presentation, the equipment and procedures used are described here.

Vacuum hopper. The vacuum hopper made by National Rubber Machinery is a closed hopper with devices for applying vacuum and feeding blend intermittently from the outside without losing vacuum. The feed mechanism is actuated by a level-sensing device in the vacuum hopper.

Blending. Dry blends were made in a 40-lb. ribbon blender, or a 170-lb. capacity Lee blender. The Lee blender is similar to a Hobart mixer. It has a series of inner blades rotating in opposite directions to the main paddle. Resin is added to the blender, and fillers, if any, are added through a 6-mesh screen and blended 3 min. with the resin. Plasticizer is added at room temperature and blended 5 minutes. Steam (15 to 20 p.s.i.g.) is applied to the blender and lubricants are added after the blend becomes free-flowing. The end temperature of the blends is generally 215 to 220° F.;

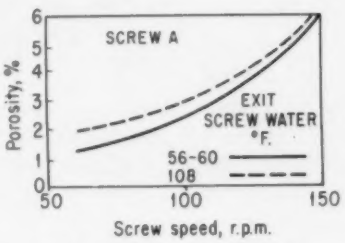

FIG. 1: Effect of screw water temperature and screw speed on the porosity of the extrudate when extruding the formulation described on p. 212. Vacuum hopper was not used.

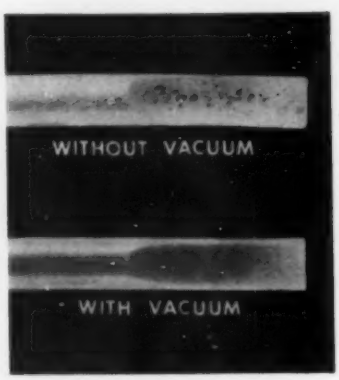

FIG 2: Two samples of rod extruded from dry blend: (top) without vacuum hopper; (bottom) with vacuum hopper. Screw speed in both cases was 150 r.p.m., which resulted in an output rate of 210 to 214 lb. per hour. Sample made without vacuum hopper had 6.15% porosity, whereas that made with vacuum hopper showed zero porosity.

Table I: Description of extruder screws

Screw	Type	Pitch	Flight depth — Feed	Flight depth — Final	No. of metering flights	Comp. ratio
		in.	in.			
A	Dry blend	2 3/16	0.502	0.125	5	3.4/1
B	Dry blend	3 1/16 to 2 3/8	0.485	0.192	0	3.4/1
C	Diced compound	2 1/4	0.367	0.159	0	2/1

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the blend is then cooled to 120° F. and stored in polyethylene bags to avoid moisture absorption.

Extruder. All of the work reported herein was done with a National Rubber Machinery Model 55, 2½-in., 20:1 L/D, electrically heated extruder. Some earlier work was done with the extruder equipped with a 15-hp. Vari-drive. Recently, the extruder has been equipped with a 2-speed 15/30-hp. Vari-drive. Extrusion dies were ½-in. round dies having lands ½-and 2½-in. long. Table I, p. 210, describes the types of screws used in this work.

Vacuum hopper with filled compounds

To study the effect of the vacuum hopper on filled dry blends, this formula for electrical insulation (in parts by weight) was used:

Polyvinyl chloride resin[2]	100
DOP	50
Clay	11
Tri-base E	8
Mineral oil	2

This is typical of high-quality T, TW, 60° C. building wire insulation compounds. Specific gravity of this formulation is 1.33. All extrusions of this formula were conducted with Screw A and the ½-in. diameter rod die with a ½-in. land. Four cylinder heaters were set at temperatures ranging from 280° F. in the feed zone to 340° F. at the head end in equal 20° F. intervals.

[2]Escambia PVC 1250-E. Relative viscosity 1% solution in Cyclohexanone at 25° C. is 2.40. Specific viscosity (ASTM D1243-58T), 0.41.

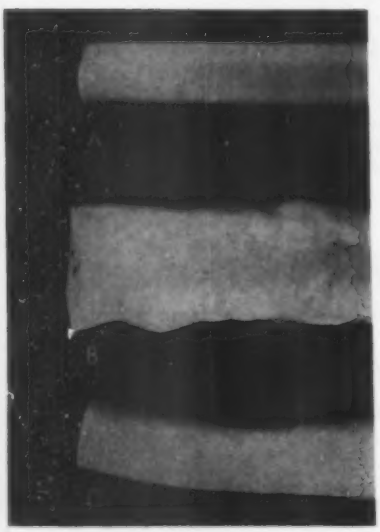
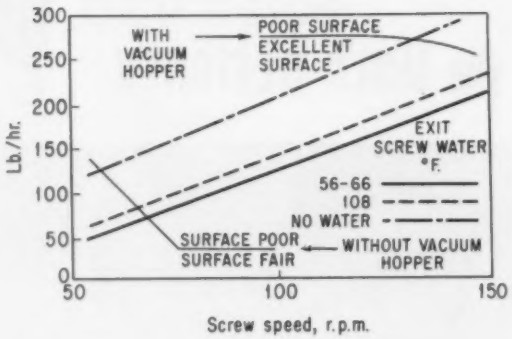


FIG. 4: Effect of extrusion conditions on dry blend extrudate quality using vacuum hopper without screw cooling.

Sample	*Screw speed r.p.m.*	*Cylin. temp. ° F.*	*Stock press. p.s.i.*	*Output rate lb./hr.*
A	44	280 to 340	1000	127
B	150	280 to 340	2800	305
C[a]	150	250 to 290	3500	270

[a]Adiabatic operation.

FIG. 3: Graph showing screw variables and vacuum hopper on extrudate surface. Note how use of vacuum allows the extruder to run at higher screw speeds and output rate while also maintaining good surface quality.



Head and die temperature were 350° F.

Without vacuum on the hopper, the extruded rod was invariably porous and had surface quality ranging from fair to extremely poor. Fig. 1, p. 210, shows screw speed vs. porosity at two screw-water temperatures when extruding without vacuum. With vacuum, porosity was eliminated completely. Fig. 2, p. 210, shows rod samples extruded with and without vacuum at a production rate of 210 to 214 lb. per hour. No substantial difference in extruder output is observed with or without the vacuum.

Fig. 3, above, shows output rate vs. screw speed at several degrees of screw cooling, with and without vacuum. Excellent surface quality and no porosity even at high rates are obtained with vacuum. Without vacuum, surface quality is fair at best and becomes poor as screw speed is increased only slightly.

Operating with vacuum at 150 r.p.m. or higher with no screw cooling water and with heat input to the cylinder and head, the product is rough. With cylinder heat off, operating adiabatically, the surface quality improves, but is still somewhat rough. Fig. 4, below, depicts these findings. Based on Figs. 3 and 4, it is concluded that for this die, the optimum surface quality and rate will be obtained somewhere between the conditions obtained with no screw cooling and with 108° F. exit screw water and adiabatic extruder operation.

The output of an extruder in pounds per hour does not define the power needs per unit of product. The results shown in Fig. 3 can be plotted as output in pounds per hour per horsepower vs. screw speed. As shown in Fig. 5, p. 214, it can be predicted that at high screw speeds, the output rate for optimum quality would be between 7 and 10 lb./hr./hp. The product extruded adiabatically at 140 r.p.m., shown as the bottom sample in Fig. 4, has an output rate of 8.9 lb./hr./hp.

The value of this type of data can be shown in the actual extrusion of insulation on wire and the evaluation of the properties of the insulation. Using the blend given above, No. 14 AWG wire was coated with insulation 1/32 in. thick with and without vacuum at several screw-water temperatures. The percent retention of elongation of the insulation after oven aging was used as a measure of quality. This is one of the most critical physical properties of vinyl-insulated wire as tested by Underwriters' Laboratories (2). For this type of insulation, Underwriters' Laboratories specify a minimum retention of elongation of 65% after oven aging for 7 days at 100° C.

Extrusions were conducted with Screw A at 57 r.p.m. and at exit screw water temperatures of 65, 85, and 150° F., and with no screw water. In all cases, using the vacuum, the insulation was free of porosity and had excellent surface quality. Without vacuum, porosity ranged from 1 to 5 percent. Fig. 6, p. 214, clearly shows the value of

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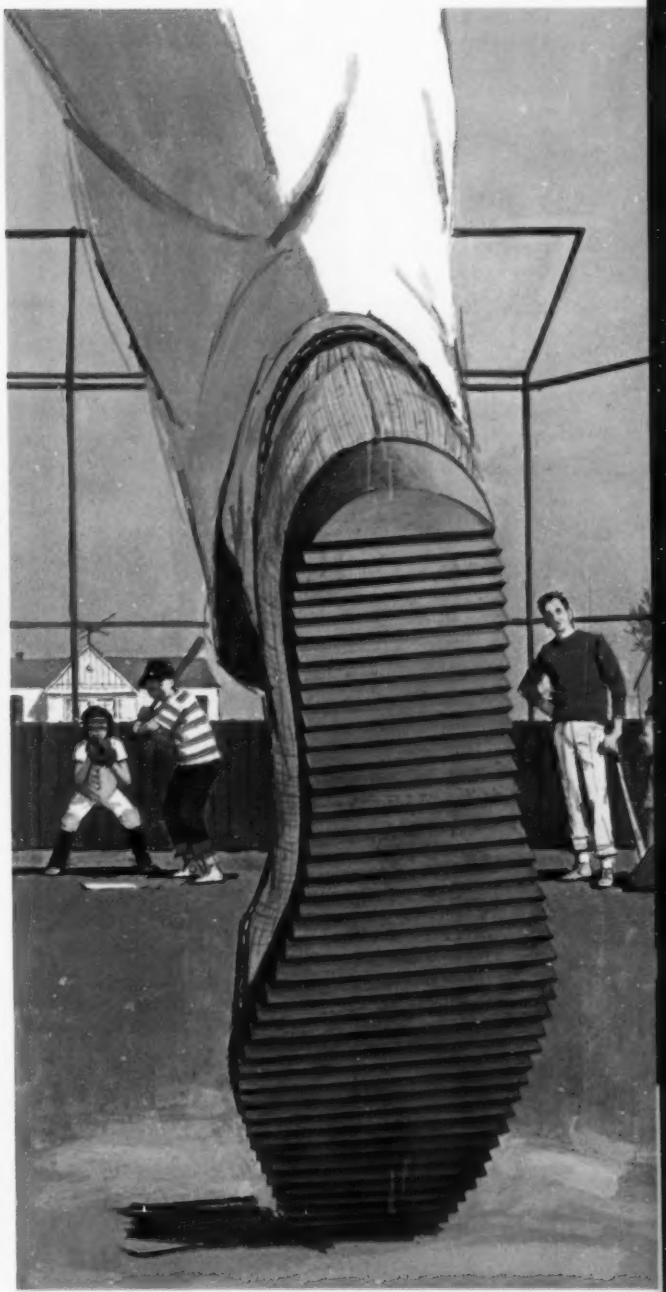

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Table II: Fisheyes per gram

Screw	Type	Screen	R.p.m. 44	75	100	150
A	Dry blend	Coarse	29	34	28	26
B	Dry blend	Coarse	28	25	37	31
C	Diced compound	Coarse	1.75	1.75	0.5	0
A	Dry blend	Fine	0	0	0	0
B	Dry blend	Fine	0	0	0	0

the vacuum hopper in this case. With vacuum, the percent retention of elongation increases from 70 to 90% as screw temperature increases. Without vacuum, the value is initially very low, rises to a maximum of 80%, and declines again to a low value. The increase in percent retention of elongation at moderate screw temperatures without vacuum is probably due to slight increases of stock temperature. Fig. 6 also shows that insulation of high quality can be obtained at increased output with the use of the vacuum hopper and proper extrusion conditions.

The wire speed obtained in the extrusion with vacuum and no screw water as shown in Fig. 6 was 250 ft. per minute. This was done with the extruder equipped with a 15-hp. drive. Recently, the power of the extruder drive was increased to 30 hp. and further extrusions on wire have been conducted at higher speeds. At a screw speed of 104 r.p.m. with no screw cooling, wire was extruded at 575 ft./min. or 210 lb./hr. of compound. The insulation had excellent retention of elongation after oven aging, superior to that extruded without vacuum at a wire speed of only 360 ft./min., using screw water. Without screw water, acceptable insulation could not be extruded without the hopper.

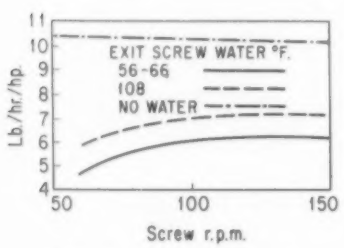

FIG. 5: Data from Fig. 3, p. 212, replotted to show output rate in terms of lb./hr./hp. Optimum extrudate quality lies between 7 and 10 lb./hr./hp.

Vacuum hopper and fine screens

Extrusion of clear products from PVC dry blends has had limited success. Products often contained surface and internal imperfections such as incompletely fluxed particles or gels commonly referred to as fisheyes. In addition, rough surface and porosity due to air and moisture have also been common in the extrusion of clear products. Clear solid rods and heavy-wall tubing are examples of products which may be rejected because of internal, as well as external, imperfections. Some companies have been forced to extrude clear dry blends, granulate, and re-extrude. Others have been forced to return to the use of diced compound. Many have never attempted dry blend extrusions.

The fisheye problem in clear material is a function of the plasticizer type and the dry blending procedure. Also, differences in various commercial types of PVC resins have been shown to be a factor (3). Extrusion equipment and extrusion conditions are also critical.

Conventional screens used in the extrusion of dry blends are generally no finer than 80 or 100 mesh. Most commercial suspension PVC resins have particle sizes finer than 80 mesh. It seems reasonable that finer screens would be of help in eliminating fisheyes due to unfluxed resin particles. Fine screens and sand filters are commonly used in nylon melt-spinning operations. It was felt fine screens could also be used to advantage with clear PVC blends.

Work in this laboratory has shown that clear formulations can be extruded from dry blend using as many as twenty 325-mesh screens. It has been found that the use of five 325-mesh screens has completely eliminated the fisheyes which are observed in extruding with a conventional three-screen pack of 20/40/60 mesh.

The clear formulation (in parts by weight) used in this study was:

Polyvinyl chloride resin	100
DOP	44
Epoxy stearate	10
Liquid barium/cadmium stabilizer	3
Stearic acid	0.5
Carbon black	0.07

This blend has a specific gravity of 1.23. The carbon black is added to facilitate counting of fisheyes. In sheets about 20 mils thick, fisheyes appear as white, unpigmented spherical spots when the sheet is viewed with transmitted light. To show the effect of fine screens, a resin with relative viscosity of 2.40 (specific viscosity, **(To page 219)**

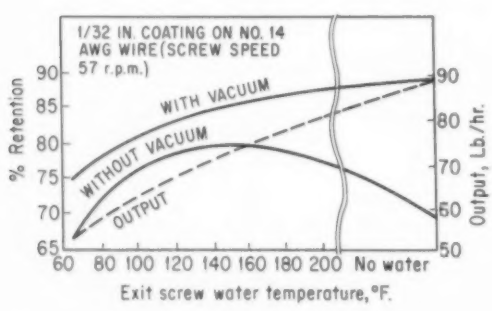

FIG. 6: Retention of elongation (after oven aging) and extruder output rate as a function of screw water temperature, with and without the use of a vacuum hopper. Data is for the extrusion of dry blend on wire.

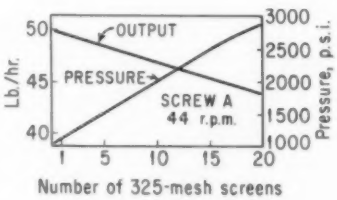

FIG. 7: Effect of the number of 325-mesh screens on the output and stock pressure developed in the extrusion of the clear dry-blend formulation described above.

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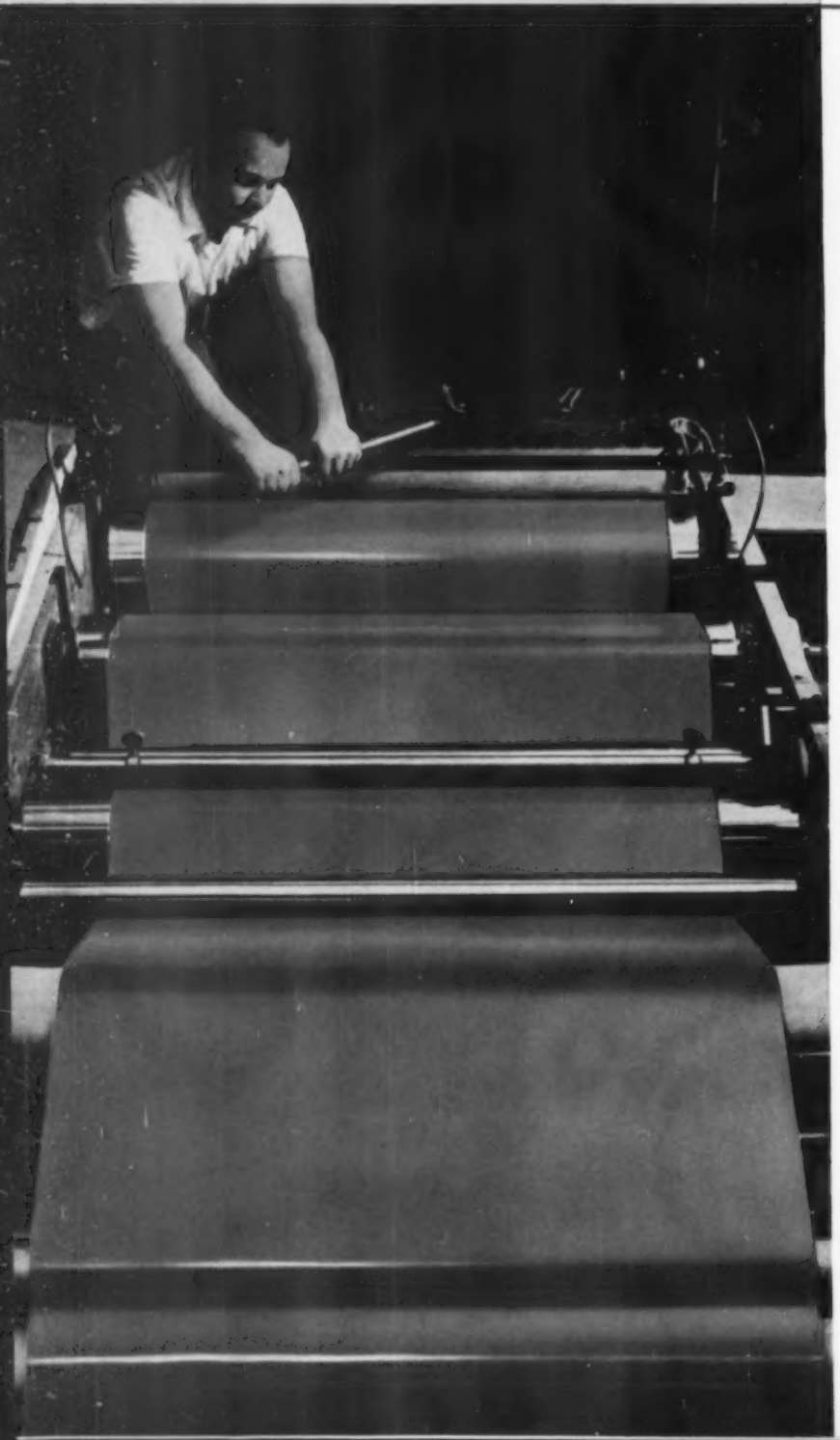

High Strength – Tenite Polypropylene has good tensile and impact strength, plus rigidity and surface hardness.

Light Weight – Tenite Polypropylene is the lightest of all solid plastics. This plastic produces more molded or extruded product per pound than most other plastics.

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Red polypropylene sheet rolls off an extruding machine in Eastman's plastics development laboratory. For two full years before launching polypropylene production on a full-scale commercial basis, Eastman engaged in exhaustive research and study of the characteristics and properties of polypropylene, thoroughly pretesting the material in actual molding and extrusion operations and developing a number of formulations for use in plastics fabrication.

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Resistance to Environmental Stress Cracking – Tenite Polypropylene has excellent resistance to stress cracking. No environment has yet been discovered in which stress cracking of polypropylene occurs.

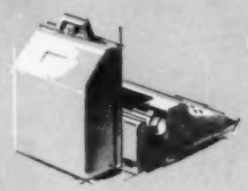
High Gloss – Articles molded of Tenite Polypropylene have a natural lustrous finish, and film extruded of Tenite Polypropylene exhibits a sparkling surface.

Heat Sealability – Tenite Polypropylene is relatively easy to "tack" or "weld." This can be accomplished in many cases with existing equipment.

Printability—With a simple treatment, film of Tenite Polypropylene can be easily printed by conventional methods.

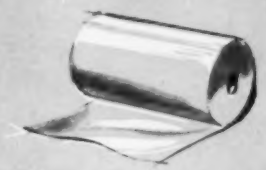
Resistance to Mold and Mildew—Tenite Polypropylene resists the growth of mold or mildew, and is not attacked by insects or marine organisms.

Processability – Tenite Polypropylene has excellent flow properties, permitting good mold-fill in injection molding.



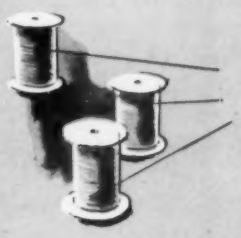
Injection Molding

Tenite Polypropylene can easily be molded into a wide variety of durable low-cost parts with high gloss and surface hardness—for example, appliance housings, automotive accessories, toys and housewares.



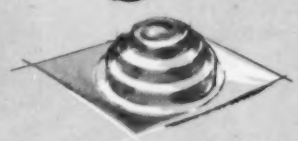
Extruded Film and Sheeting

Tenite Polypropylene can be extruded into sparkling clear film and sheeting, with the excellent protective characteristics so important for durable packaging. It can also be extruded in opaque, translucent, or transparent colors.



Monofilament

Tenite Polypropylene can be extruded into monofilament offering high strength, wet or dry, and excellent flexibility at low temperatures. Webbing for outdoor furniture and cordage are among the many possible end uses for this tough material.



Thermoforming

Sheet of Tenite Polypropylene can be used in vacuum forming, pressure forming and skin packaging, with existing equipment.

Wire and Cable Covering

Excellent electrical, thermal, and mechanical characteristics make Tenite Polypropylene desirable for either primary insulation or jacketing. Formulas are available for solid coatings, or for cellular coatings of extra-low dielectric constant.

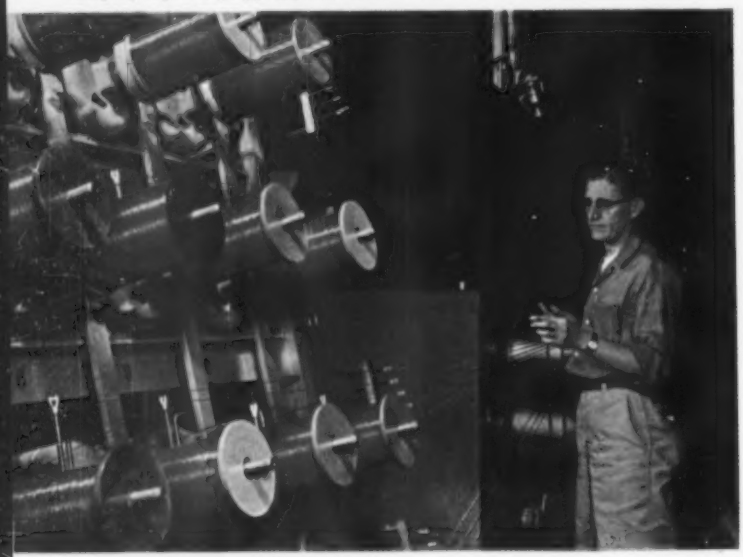
Pipe

Chemical inertness, resistance to stress cracking, and heat resistance make pipe of Tenite Polypropylene a good choice for industrial use.

Blow Molding

Tenite Polypropylene in special formulations can be blow-molded into many articles possessing exceptional wall strength, resilience, and chemical resistance.

Spools of lustrous red polypropylene filament, extruded for testing purposes in Eastman's development laboratories. Eastman's work over many years in producing plastics of almost unlimited colors has been of significant value in developing superior polypropylene formulations for monofilament extrusion.



A special word about this new polypropylene

The process for manufacturing Tenite Polypropylene was developed by Eastman scientists, engineers and production staff. This exclusive process yields a polypropylene that is superior in several characteristics to other polypropylenes. We base this statement not only on our own laboratory findings but on the opinions expressed by those users who have had the opportunity to evaluate Tenite Polypropylene from our semicommercial plant during the past year.

Since the first Tenite plastic was produced, in 1932, over 42,000 color effects have been formulated in the Tenite color laboratory. This experience, plus pre-eminence in color photography and textile dye technology, enables Eastman to offer the broadest range of colors available in the entire plastics industry. We believe that Tenite Polypropylene represents an improvement in quality and stability of color in this type of plastic. And Tenite Polypropylene color concentrates now offer molders and extruders a clean, easy way to color polypropylene. Use of these concentrates virtually eliminates color contamination and color uncertainty.

We have given you only the highlights on this promising new plastic. For further information, call a Tenite sales office or send this coupon to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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This glimpse into the color chip storage room at the Tenite Color Laboratory gives some indication of the variety of colors that has been developed by Eastman since 1932.

Measuring the optical properties of Tenite plastics is but one phase of the diverse and thorough testing done in the Tenite Quality Control Laboratory.

Eastman technical service representatives are ready to work with any customer in finding the most efficient way in which to fabricate products of Tenite Polypropylene.

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Other plastics made by Eastman include Tenite Polyethylene, Tenite Butyrate, Tenite Propionate, Tenite Acetate, and Tenite Polyester. Information on any of these materials is also available on request.

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ASTM D1243-58T, 0.41) was used. Because of prior experience, it was felt that the vacuum hopper was a must in the extrusion of clear dry blends using dies of large cross-section. The die used was a ½-in.-diam. rod die, having a land of 2½ inches. In certain cases, vacuum was omitted to demonstrate the nature of the product that would be obtained without vacuum.

At first glance, it might seem that 325-mesh screens would cause a tremendous reduction in extruder output. To determine the effect of the number of 325-mesh screens on output and stock pressure at the breaker plate, a series of extrusions was conducted using 1, 5, 10, 15, and 20 screens of 325-mesh supported in the front by 20/40/60 screens and in the rear by an 80-mesh screen. Screw A, described in Table I, p. 210, was used. Results are shown in Fig. 7, p. 214. At 44 r.p.m., twenty 325-mesh screens produced a stock pressure of 2900 p.s.i. compared with 1000 p.s.i. with the use of 20/40/60 screens. Output decreased slightly, as expected, with this increase in stock pressure with this type of screw.

It was of interest to determine the differences in the product quality and output at these same pressures using valved extrusion. By using a cross-head on the extruder, a valve was constructed which could be operated to produce any desired stock pressure at the end of the screw by adjusting a movable mandrel, thereby varying the restriction between the pin and the die. Fig. 8, above, shows a schematic diagram of such an extruder crosshead. As seen in Fig. 9, right, the curve of output rate vs. pressure drops off more rapidly with the valve than with the fine screens. Note that this does not imply that valving done at a different site, such as at the end of the screw or in the opening immediately behind the crosshead, would produce the same output vs. pressure curve.

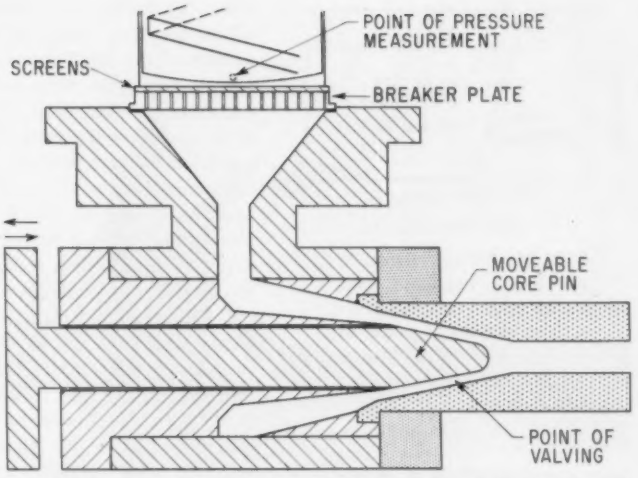

FIG. 8: Diagram of the extruder cross head used to study the effect of valved extrusion of dry blend on extruder output and pressure.

To assess the effect of the fine screens on the elimination of fisheyes, a technique for determining fisheyes per gram was developed. A 5-g. sample of extruded rod was pressed at 370° F. between Ferrotype plates using 20-mil shims. The sample was pressed at contact pressure for 45 sec., releasing the pressure briefly at 15-sec. intervals, and finally pressing for 15 sec. at 5000 lb. total ram pressure. A uniform sheet suitable for counting fisheyes was obtained. Fisheyes were counted by observing the pressed sheet with transmitted light on a ground glass screen. The total number of fisheyes was counted and reported as fisheyes per gram.

Fisheyes per gram were determined on the rod samples which had been extruded to obtain the data for Figs. 7 and 9. The results of these findings are plotted vs. stock pressure in Fig. 10, p. 220. Fisheyes per gram remain essentially constant at a value of 23 with the valving techniques. Fisheyes per gram with one 325-mesh screen are high but drop off rapidly to an insignificant level with five 325-mesh screens. The fisheyes observed with one 325-mesh screen are much smaller in size than those observed with coarse screens. The fact that one 325-mesh screen permits the passage of some 25 fisheyes per gram while five 325-mesh screens virtually eliminate the fisheyes indicated that the particles are being retained by the screens until sufficiently plasticized to pass through as homogeneous material. A 10-hr. extrusion trial, using ten 325-mesh screens, showed no loss of output with extrusion time, indicating that the particles were not plugging the screens and reducing output.

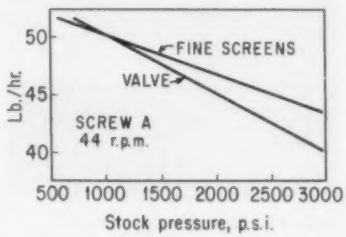

FIG. 9: Extruder output rate as a function of the stock pressure for a valved head vs. fine screen packs.

It became of interest to determine the quality of product at a range of screw speeds. A comparison was made of a fine-screen pack consisting of 20/40/60/5-325/80-mesh screens and a coarse-screen pack consisting of 20/40/60-mesh

Table III: Fisheyes per gram—several commercial resins extruded with coarse screens

Resin	*R.p.m.* 44	75	100	150
Escambia PVC 3250	1.5	1.0	0.5	0.12
Resin A	70.0	41.0	33.0	17.0
Resin B	62.0	38.0	—	—
Resin C	5.0	4.0	2.5	1.0
Resin D	2.5	0.56	0.5	0.25

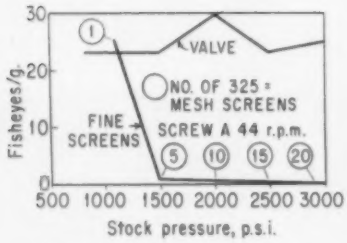

FIG. 10: Fisheye content of rod-shaped extrudate, produced under conditions described by Figs. 7 and 9, as a function of the stock pressure using valved vs. fine-screen extrusion methods.

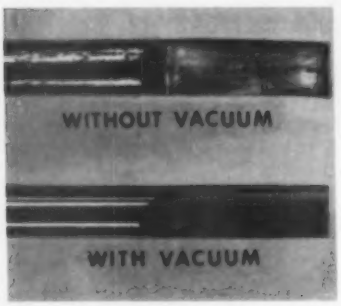

FIG. 11: Samples of extruded rod made with a screen pack containing five 325-mesh screens. Upper sample made without vacuum hopper exhibits 1% porosity, while lower sample made with vacuum hopper has no porosity and relatively perfect surface. Both samples made at screw speeds of 150 r.p.m.; output rates of 188 lb. per hour.

screens. The effect of the vacuum hopper on this type of extrusion is shown in a comparison of products obtained with and without vacuum at 150 r.p.m. (Fig. 11, above). Again, as with the filled compound, it is noted that output in pounds per hour does not seem to be different with or without the vacuum. The effect of fine screens in removing surface and total fisheyes, as measured in fisheyes per gram, is shown in Fig. 12, right.

A comparison of two dry blend screws, A and B of Table I, in extruding dry blends was made with a granule screw (C) in extruding diced compound. This diced material was prepared by fluxing the hot dry-blended compound in a 40-lb. Struthers-Wells intensive mixer, followed by milling on a mill 16 by 42 in., and then dicing. In the preparation of the diced compound, the fisheyes per gram were determined on samples taken from the batch after mixing in the intensive mixer and after a 5-min. milling. The values ranged from 18 to 23 and 5 to 14, respectively, for 5 batches. The extrusions were first conducted with the three screws using coarse-screen packs at screw speeds of 44, 75, 100, and 150 r.p.m. The dry blend screws A and B were also used to extrude the dry blend with the fine-screen pack. Fisheyes per gram were determined on the extruded rod. The dry blends were extruded with vacuum, the diced compound without vacuum. The results are summarized in Table II, p. 214. These data indicate that a clear product with qualities that are much superior to those obtained with diced compound can be extruded from dry blend with the use of five 325-mesh screens.

Examination of the rod extruded from diced compound and coarse screens revealed some interesting facts. Although the fisheye count on the diced material was low, the extruded rod had a much poorer appearance than would be expected for such a low count. Another extrusion of the diced compound, made exactly the same way except for the elimination of the carbon black, produced a transparent rod which had a very large number of internal, as well as surface, imperfections. Extrusion with fine screens eliminated these difficulties. This leads to the conclusion that imperfections in extruded products are not always fisheye, in the sense of being unfluxed or incompletely plasticized resin particles. It is felt that these "non-fisheye" defects may be due to pick-off of degraded material from the screw cylinder or other parts of the system. Cross-linking due to heat degradation and/or oxidation as observed in polyethylene (4) may be responsible for this.

Some additional information on the output rate with the three screws is of interest. Fig. 13, right, shows the output in pounds per hour per horsepower vs. screw speed for the three screws. Screw B, an older design, having a decreasing pitch and decreasing depth, shows greater efficiency. The surface quality of the product that was extruded with the two dry blend screws at high screw speed was equivalent.

The temperature of exit screw water for these extrusions ranged between 63 and 72° F. Referring back to Fig. 5, it was shown that with filled compound, much higher outputs in pounds per hour per horsepower could be obtained with reduced screw cooling. The higher screw temperature used with Screw C at 75 to 150 r.p.m. may be the reason for the sharp rise and higher level of this curve compared with that of Screw A. It is felt that further increase in output of clear materials with any of these screws could be obtained using the vacuum hopper and fine screens and the screw operating at higher exit-water temperatures. However, it is felt that less latitude **(To page 346)**

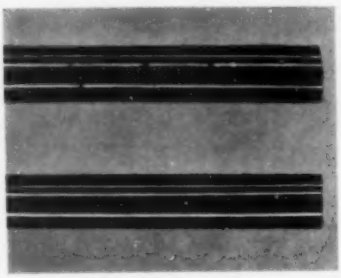

FIG. 12: Samples of extruded rod showing how the use of five 325-mesh screens in the extruder screen pack reduced the fisheyes content from 30 to 0.25 fisheyes per gram. Lower sample was made with fine screws; both samples extruded at 100 r.p.m. screw speed at output rates of about 105 to 113 lb. per hour.

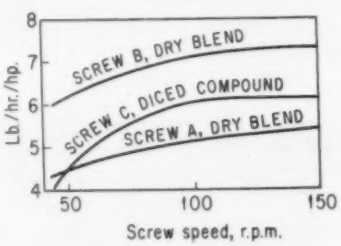

FIG. 13: Effect of screw design on the extruder output rate per horsepower as a function of screw speed. Screw Types A, B, and C are described in Table I.

FIRE retardant for PLASTISOLS: CHLOROWAX® LV by DIAMOND

Suggested Formulation for Flame Retardant Plastisol

	Parts
Diamond Alkali PVC-70	100
DIOP	18
Santicizer 141 (1)	45
Chlorowax LV	10
Antimony Trioxide	10
Tinuvin P (2)	0.05
Mark KCB (3)	2.5
Paraplex G-62 (4)	5

(1) Monsanto Chemical Company (3) Argus Chemical Corporation
(2) Geigy Chemical Corporation (4) Rohm and Haas Company

Viscosity	Brookfield Model RVT-200 #6 Spindle 100 RPM
Initial	29.8 poises @ 77° F
48 Hours	44.0 poises @ 77° F
Brittle Point	−47° C
Fadeometer	No discoloration after 300 hours
Diamond Alkali Loop Test	No Spew

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raw material to finished product

BANBURY MIXERS are constantly being improved for plastics processing. Among recent innovations is the drop-door construction which shortens cycle time, provides almost instantaneous discharge of batch, and reduces contamination of one batch from another.

UNDERWATER PELLETIZERS are a recent addition to the Farrel line of heavy-duty extruders. They are designed for the continuous working of materials as cold-feed machines or handling the discharge from a Banbury or a reactor.

For many years, Farrel has been the leading supplier of machinery for three separate divisions of the plastics industry: processing, molding, and calendered film and sheet.

This three-way leadership has been maintained with new ideas . . . and the development of machines to carry out those ideas. For example, in the field of processing, high-horsepower Banbury mixers for working the hard-to-handle plastics, and underwater pelletizers are two recent innovations. For molders using the new high-strength materials or seeking improved results with older materials, the Watson-Stillman Press Division is introducing the new machines illustrated below. For film and sheet, Farrel's inclined "Z" calender is establishing new standards for accuracy, versatility and convenience.

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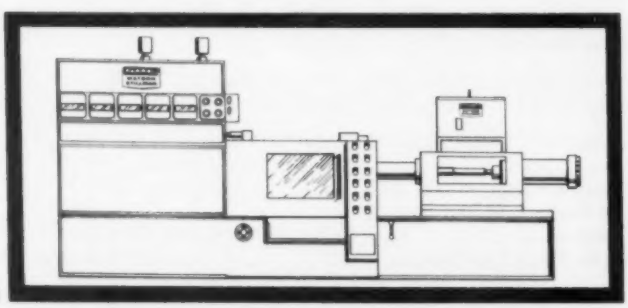
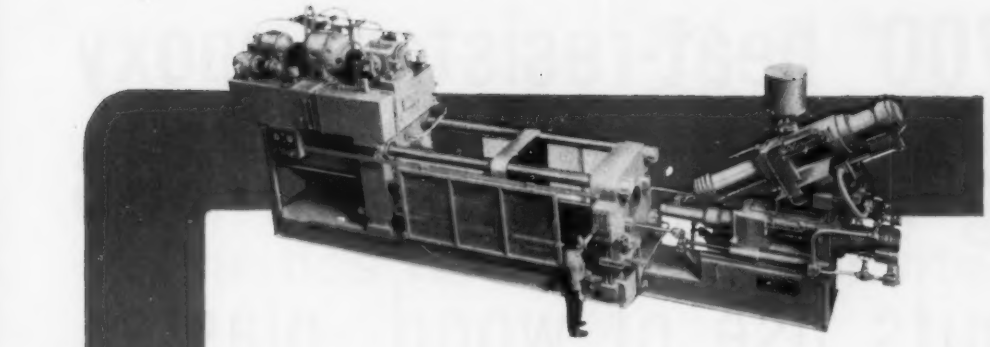
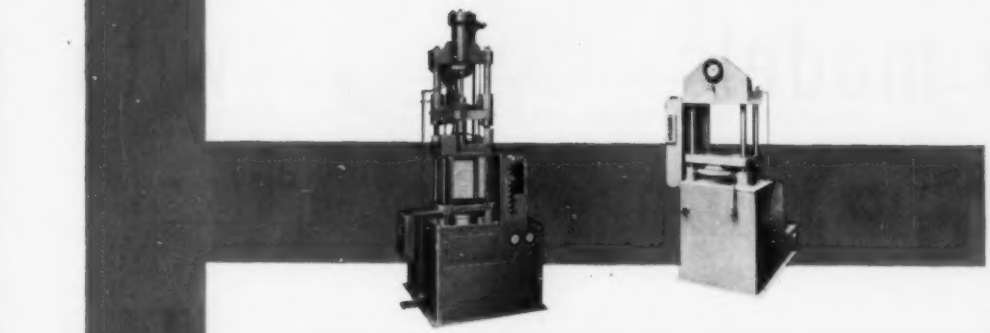


RIGHT — Brand new Farrel Watson-Stillman 12-20 ounce plunger and screw-type machines will be demonstrated at the National Plastics Exposition. See them at booths 521 and 525 or write for complete details and specifications.

WS-82

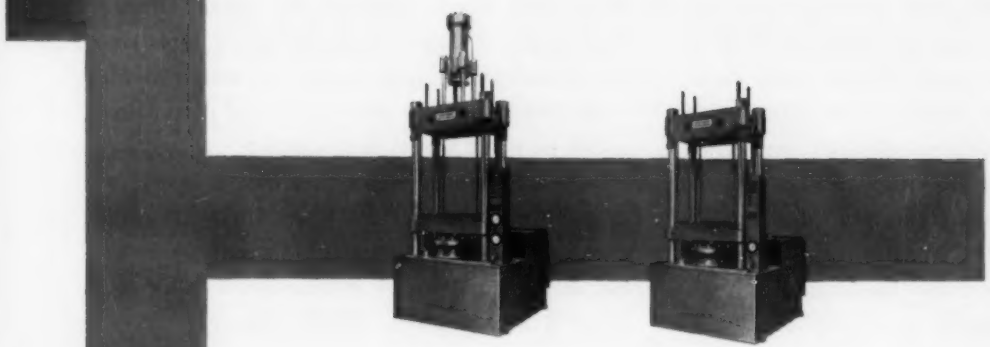


HORIZONTAL INJECTION MACHINES—A pioneer in the development of straight-shooting and preplasticizing-type machines, the Watson-Stillman Press Division has continued to make important improvements in these machines. New designs will consistently turn out products of improved strength, dimensional stability and surface finish. Available in capacities from 5 to 500 ounces. Illustrated is a 175-ounce, preplasticizing-type machine.

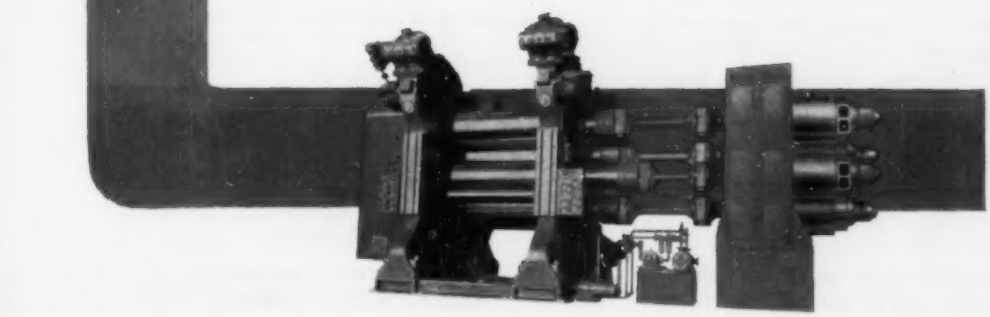


VERTICAL INJECTION MACHINES — In addition to conventional molding, Farrel Watson-Stillman vertical machines are ideal for producing parts requiring loose cores and inserts. They are designed for high-speed production at low operating cost. They are available in 1, 2, 6, 16 and 22-ounce sizes, which provides a machine of the proper capacity for any production requirement. A 2-ounce machine is shown at the far left.

GENERAL PURPOSE PRESSES — Designed for short run jobs, laboratory and experimental work, these presses can be furnished with steam or electric hot plates. Available in 30, 50, 100 and 200-ton capacities. The 50-ton size is illustrated.

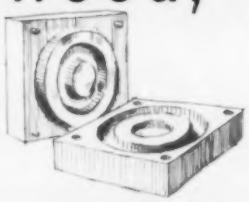


COMPRESSION AND TRANSFER MACHINES have the same ruggedness of design that has characterized Farrel Watson-Stillman hydraulic equipment for over a century. Built for high-speed operation, they are the four-column, upward-movement, open type which provides easy accessibility to the molds. Available in a choice of sizes, with clamping capacities from 50 to 1200 tons. 150-ton transfer and compression machines are illustrated.



FARREL CALENDERS are built in sizes from small 6" x 13" units for the laboratory up to the largest production units. The machine illustrated is a special inclined "Z" calender with individual motor to drive each roll. With this arrangement, stepless friction ratio variations between rolls are possible over an extremely wide range. Designed for operation at temperatures up to 500°F, this calender is capable of producing a wide variety of products.

New...700° heat-resistant epoxy casting resin...MARASET 666

...permits use of wood, plaster, or clay models  with a **half-hour** curing cycle!

Pattern costs are shaved because Marblette's new Maraset epoxy resin 666 becomes rigid at 150° F.—so that casting can be done from wood, plaster, or clay models. These will not deform with this resin, as they would at the elevated cure needed for other high-heat plastics. Rigidity is maintained at greater heat in post-curing and at operating temperatures up to 700° for short periods and up to 570° for longer periods—the highest heat resistance so far available for any epoxy resin.

Time and labor savings are great because many types of high-heat molds, plastic tools and dies, foundry dies, injection and compression molds —for prototype work and limited-run production —can be made in less than one working day, as against the many days and many more hours required for machining metal counterparts. Maraset epoxy resin 666 with its special Marblette hardener can be pre-cured in just an hour-and-a-half, post-cured in as short a time as half-an-hour.

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Plastics for solid propellants

By Alfred J. Zaehringer†

Some of the basic problems of rocket fuels have been solved by the introduction of plastics as fuel-binders. Solid rocket propellants are now seriously challenging liquid rocket fuels. New plastics and polymers may create "hybrid" solid propellants that will make possible an even more practical push into space.

The first solid propellant, gunpowder, consisted of an oxidizer (potassium nitrate) and a fuel combination (charcoal and sulfur). These finely ground materials were intimately mixed and then pressed into a solid shape or "grain." This type of solid propellant was used almost without change right up to World War II. Indeed, the common "skyrocket" is still made this way. There were several major problems with pressed gunpowder charges. First, performance was quite poor. Second, cracking of the charge or "grain" often lead to disastrous rocket failures. Third, scale-up was difficult if not impossible, even if the first two problems could have been solved. Therefore, despite its simplicity, the solid rocket was temporarily by-passed by the high-performing, expensive, and complex liquid rockets that were used in World War II.

To understand how plastics are used in solid propellants, we must first understand what a solid rocket is and how it is to perform. The exothermic reaction of an oxidizer (say an oxygen-liberating material) and a reductant (a fuel like a hydrocarbon or a plastic) heats the reaction gases up to high temperatures in a closed "combustion chamber." These exhaust gases are then allowed to escape through a nozzle, and the resulting expansion process converts the heat energy into kinetic energy. Via Newtonian action-reaction principle, a "thrust" force is developed which is opposite in direction to the escaping gases. Thus, the rocket is a type of heat engine. Since all propellants are carried within the rocket, the system can operate independently in almost any medium, *e.g.*, underwater, in the air, or even in a vacuum. The best operation actually is in a vacuum.

Liquid rockets use monopropellant or bipropellant systems. In the latter, oxidizer and fuel are stored separately in tanks and then metered into the combustion chamber. The solid rocket has both oxidant and fuel stored within the combination reaction-storage (combustion chamber) vessel. Fig. 1, below, illustrates a modern solid rocket using a case bonded, internal burning grain. It should be noted that the term "grain" is merely a carryover from ancient times as now the charge can often be several tons in weight.

Since the prime function of a rocket is to produce thrust for a given time, a parameter called "specific impulse" (1)[1] has been utilized to rate the performance of a rocket propellant. Impulse is the mathematical product of thrust and time. Specific impulse is the amount of thrust that a unit weight of propellant will produce in a unit time. Designation is usually lb. (force) -sec./lb.(mass) or sometimes loosely just as "seconds." Thus, specific impulse, I_{sp}, is given by

$$I_{sp} = \frac{Ft}{W_p} \qquad \text{Eq. 1}$$

where F is force or "thrust," t is time, and W_p is the weight of the propellant. High specific impulse is achieved by having the exhaust gas molecular weight as low as possible and the combustion temperature as

[1]Numbers in parentheses designate references at end of article, p. 350.

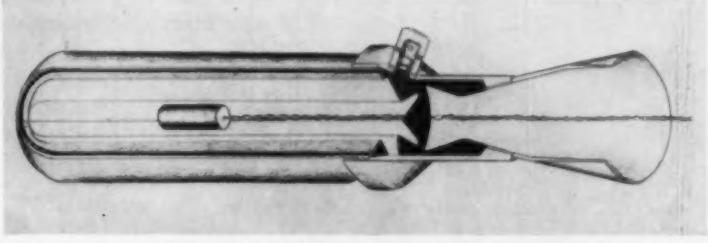

FIG. 1: Solid rocket. Cut-away shows case, case-bonded propellant (internal burning type) with igniter (center), which initiates combustion. Nozzle (right) converts chemical energy of combustion of oxidizer and plastic fuel-binder into kinetic energy to give thrust.

*Reg U. S. Pat. Off.

†President, American Rocket Co., Taylor, Mich.

high as possible (2). Also, the combustion chamber pressure should be as high as possible and exit gas pressure as low as possible.

The heat of combustion should also be as high as possible on a unit volume basis. Although a fuel may have a high heat of combustion on a weight basis, it may be low on a volume basis. Thus, in a given rocket it is possible to place more of a low performing fuel and still be more efficient than a higher performing fuel of very low density. Representative fuels, including some plastics for fuel-binders, are rated as to heat of combustion in Table I, p. 229. Two monopropellants commonly used in homogeneous or colloidal solid propellants are also included in the table. Although the heat of combustion (in this case combustion with itself) is low, the density is high.

Heat of combustion is not the only criterion. We must furnish a convenient oxidizer, usually solid, easy to decompose in the combustion chamber, but relatively stable otherwise. Table II, p. 229, illustrates the problem. We have taken a hypothetical organic fuel, C_2H_4, and calculated how much typical oxidizer is needed for complete combustion. The result is often discouraging, and illustrates that the limitations are usually likely to lie with the oxidizer rather than with the fuel-binder. The fuel-binder, however, is most likely to determine other advantages of a typical propellant, such as ease in processing or outstanding physical and chemical properties in the grain.

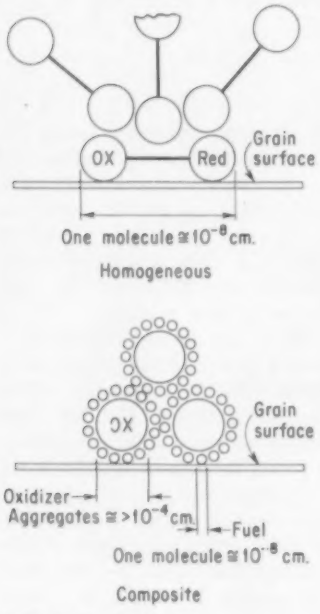

FIG. 2: Grain detail.

Solid propellant systems

Solid propellants are mainly of two types, homogeneous and composite. These two basic types are illustrated by the drawings in Fig. 2, left.

Homogeneous propellants are usually single molecules (as in nitrocellulose) or mixtures of molecules in which oxidant and fuel are in the same phase. Single-base propellants use nitrocellulose; double-base propellants are colloidal mixtures of nitrocellulose and nitroglycerine (3). The so-called colloidal propellants offered the first big performance step above the usual specific impulse of 70 to 100 sec. obtainable from gunpowder. The early double-base propellants were usually processed with the aid of solvents and gave 180 to 200 sec. performance. Later, solventless processes came into being and ushered in the era of the large rocket. For example, near the end of the war, the Germans produced a multi-stage rocket which could compete (at least range-wise) with the bigger and much more complex V-2 liquid rocket. Whether they will be able to compete with other types of solid propellants for the truly multimillion pound thrust sizes is to be proven.

Composite propellants seemed to offer a better resolution for the propellant problem. A plastic material acts not only to bind the solid oxidizer particles together but also serves as the fuel for combustion. Hence the name "fuel-binder."

During World War II a mixture of asphalt and oil was heated and mixed with finely ground potassium perchlorate to prepare the Smoky Joe JATO (jet-assisted takeoff) units used to boost heavily loaded aircraft on takeoff. Specific impulse performance of this mixture was about 180 seconds. Next came the use of synthetic resins, in particular a thermosetting polyester casting resin (4). Then, at the end of World War II, the Jet Propulsion Laboratory (now a part of NASA) used a polysulfide polymer as a fuel-binder (5). Early ammonium perchlorate and polysulfide propellants gave specific impulses of 225 seconds. This combination formed the standard for quite some time, but now other polymers have started to make substantial inroads and have given, with metal additives, performances of 250 to 275 seconds. The process most often used is simple casting, but

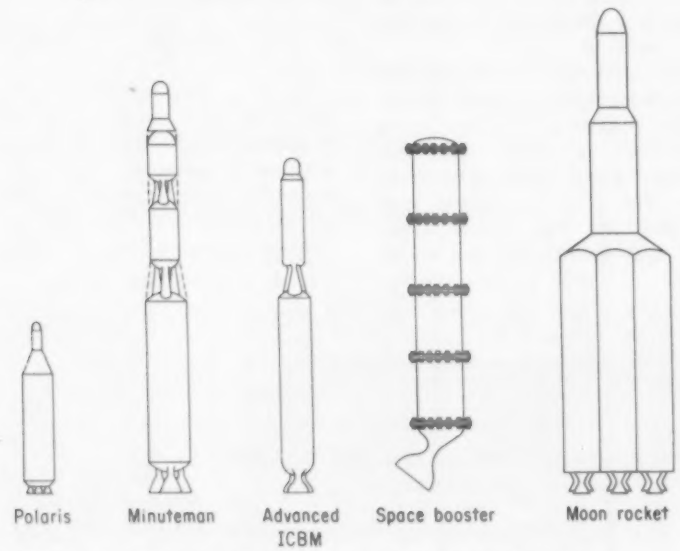

FIG. 3: Five different solid rockets. Approximate tons of plastic (fuel-binder, liner, and case, if made of plastic) that is burned by each: Polaris IRBM, 2½; Minuteman, 5; Advanced ICBM, 4; segmented booster of 2,000,000-lb. thrust, 10; and moon rocket, 56.

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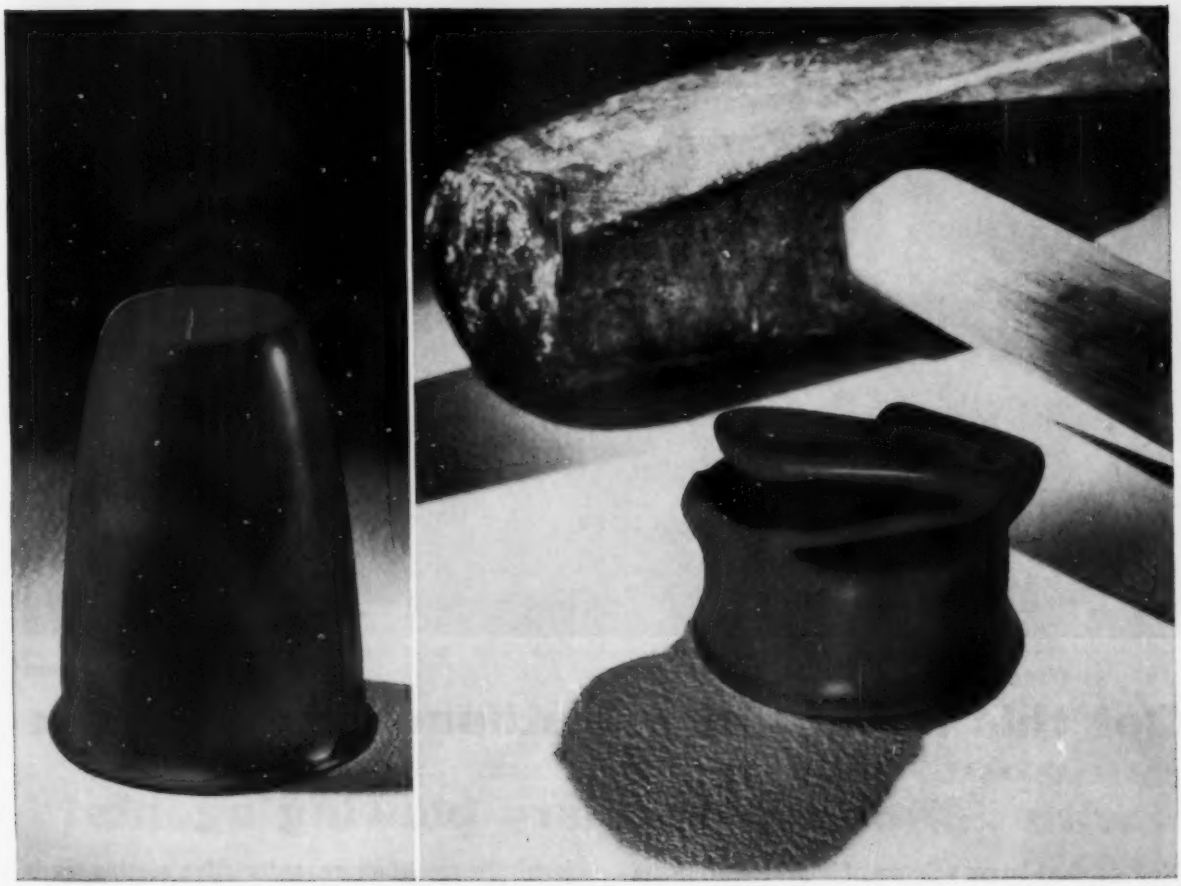

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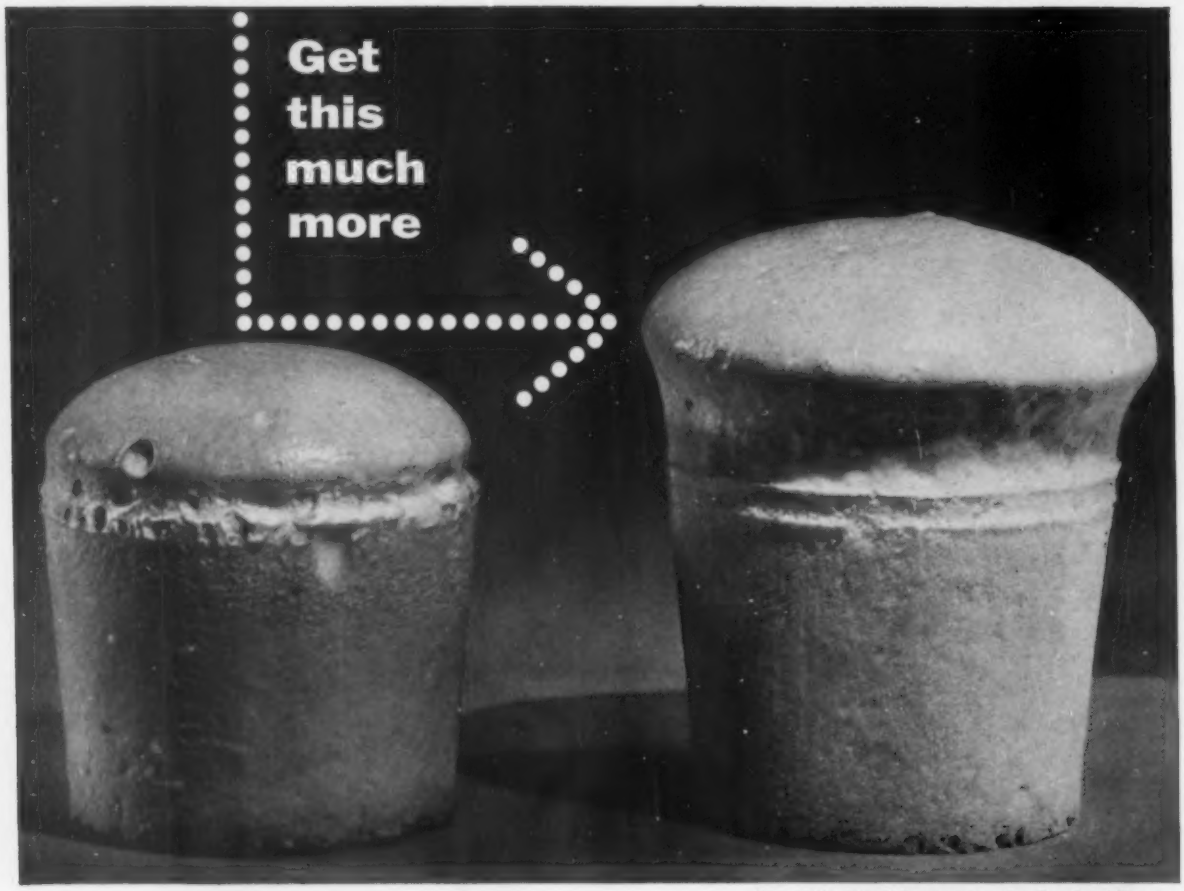

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extrusion has been used on some items. The polyurethanes (6) and polybutadienes (7) are now coming into use as fuel-binders. It also appears that homogeneous and composite propellants have begun to merge. Some double-base propellants now include solid oxidizer along with small amounts of plastic binders. Nitrocellulose, nitroglycerine, and diethylene glycol dinitrate have been introduced into composite propellants.

Oxidizers for composites are not limited to oxygen systems. The concept of any material that can accept electrons in a chemical reaction is a more accurate representation of an oxidizer. For this reason, there is now work on fluorine oxidizers. Indeed, there are reports of the possible use of fluorine-yielding polymers in the production of solid propellants.

Solid rockets (Fig. 3, p. 226) are seriously challenging the large liquid rockets. We already have an operational IRBM (Polaris), and an ICBM (Minuteman) has been successfully tested. On-site processing or casting has been suggested as a method for production of even larger solid rockets. Also, there is work on segmented solid rockets. One such segmented motor, weighing 20 tons and producing 400,000 lb. of thrust, has been successfully tested. Work is underway on solid rockets of multi-million pound thrust. Solid propellants will be used not only for military missiles but also as boosters for satellite and space shots.

Plastic fuel-binders

Although almost any hydrocarbon could serve as a fuel, an organic polymer that will bind together large amounts of solid oxidants is preferred. With the advent of large grains of complex shapes, a liquid polymer capable of being cured easily to a solid was needed. In addition to ease in processing, the grain must meet a wide variety of environmental conditions (*viz.*, military operations over a temperature range of —40 to 140° F.) plus resistance to deformation and ability to take high accelerations (say 2 to 20 G's).

Most solid propellant formulations operate at about 15 to 25% fuel-binder concentrations for ammonium nitrate propellants and about 25 to 35% for ammonium perchlorate types. The effect of loading with oxidizer on two typical casting resins is shown in Fig. 4, right. At stoichiometric conditions, the strength would be very poor. However, at the usual practical loadings, the strength is of the order of 800 to 1000 p.s.i. in tension. It is also desirable to use a combination of particle sizes to produce the dense and strong grain needed. A recent MIT project has achieved high strengths at high filler loadings with epoxy resins, yielding a minimum tensile strength of 800 to 1000 p.s.i. at 6 to 12% total binder concentration. With the exception of certain parts within the grain (*e.g.*, at the base of star points), much of the load on the grain is in compression. Typical operating pressures are on the order of 500 to 1500 p.s.i. Typical combustion temperatures range from 2500° F. for "cool" burning ammonium nitrate to 4500 to 5000° F. for high energy ammonium perchlorate propellants. The heat capacity of the oxidizer and the insulating characteristics of the plastic fuel-binder protects the relatively thin-shelled pressure vessel, which is constructed of metal or reinforced plastic.

Burning of plastic propellants

Recent studies of burning in composite propellants indicates the important role of the oxidizer. The

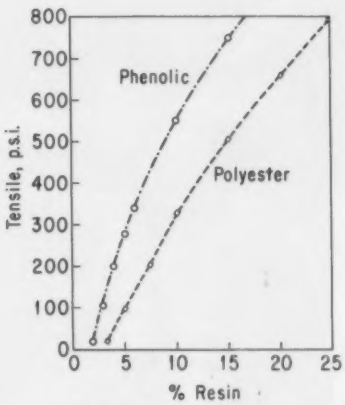

FIG. 4: Tensile strength versus resin content.

Table I: Fuel performance

Fuel	*Heat of combustion* B.t.u./lb. fuel	*Specific gravity*
Asphalt	17,100	1.1 to 1.5
Carbon (graphite)	14,087	1.8
Decaborane	28,000	0.94
1-ethyl naphthalene	17,020	1.01
Natural rubber	19,380	0.94
Polyethylene	19,980	0.93
Polyisobutylene	20,160	0.91
Polystyrene	17,892	1.05
Paraffin	18,500	0.95
Synthetic rubber (Buna S)	18,713	0.94
Nitroglycerine[a]	3,184	1.6
Nitrocellulose (12½% N)[a]	1,573	1.66

[a]Without oxidizer.

Table II: Fuel stoichiometry

Oxidizer	*Available oxygen* % by wt.	*Stoichiometric properties for C_xH_y fuel* — *Oxidizer* % by wt.	*Fuel* % by wt.
Ammonium nitrate	19.5	94.98	5.52
Ammonium perchlorate	34.2	90.97	9.03
Lithium perchlorate	60.1	85.05	14.95
"Ideal" oxidizer	100.0	77.39	22.61

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TEST RESULTS: 7 DAYS @ 121°C

	U. L. Specification Minimum	DTDP Plasticizer
Elongation	65% retention	109% retention
Tensile Strength	65% retention	101% retention
Dielectric Strength	50% retention	127% retention
Insulation Resistance*	.01 megohm based on 1000 ft.	0.36 megohm based on 1000 ft.

* 1 day and 7 days @ 113°C.

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burning rate of ammonium perchlorate propellants, for example, is almost equal to the propagation rate for pure oxidizer (9). The role of fuel-binder in composite propellant combustion involves these steps (10):

1. The solid oxidizer gasifies via endothermic surface evaporation (rate-controlling).

2. A gas-phase oxidizer pyrolysis gives flame above the oxidizer particles and binder matrix.

3. The binder is pyrolyzed via endothermic reaction in the flame zone.

4. Products of oxidizer and binder pyrolysis react exothermically in the gas phase. This constitutes an automatic, self-sustaining, "feed back" system in which the deflagration front is propagated back through the propellant.

The burning of all propellants is governed by the burning rate-pressure relationship

$$B = k\,(p_c)^n \qquad \text{Eq. 2}$$

where B is the burning rate in in./sec., k is a constant, p_c is the combustion chamber pressure in p.s.i., and n is a dimensionless exponent. A log-log plot of burning rate and pressure gives a straight line, the slope of which is n. For practical propellants n lies between 0.2 and 0.8. Above this value, the propellant burning is not likely to be stable. Although fuel-binder can change n slightly, it appears that n is more likely to be a characteristic of a particular oxidizer.

Ammonium nitrate gasifies at a low temperature (melting point of 169° C. and decomposition point of about 310° C.); hence, the binder "sticks" above the surface of the oxidizer and decomposition of the plastic takes place in the hot outer region of the oxidizer thermolayer as illustrated in Fig. 5, right. Here we see the pockets and from around these pockets issue the ablating or pyrolyzing fuel streams. These streams eventually disappear in the outer flame zones. Thus, the binder usually plays a secondary role in ammonium nitrate propellants and diffusion determines the burning rate. The burning rates of typical ammonium nitrate propellants is about 0.001 in./sec. at atmospheric pressures and about 0.1 in./sec. at 1000 p.s.i.

Ammonium perchlorate decomposes at a higher temperature (about 790° C.) at a rate about the same or lower than the binder. Usually the ammonium perchlorate particles stick up beyond the burning surface. Figure 6, below, shows an oblique view of a thin but wide strand of ammonium perchlorate oxidizer-plastisol propellant. Typical burning rates of ammonium perchlorate and plastic fuel-binder propellants are 0.1 to 0.5 in./sec. at 1000 p.s.i.

Requirements of fuel-binders

The characteristics of an ideal plastic fuel-binder (11) are enumerated below:

1. A high percentage of hydrogen, available oxygen if possible, and as little carbon as possible.

2. For smokeless conditions, no halogens, metals, or semi-metals.

3. High density (over 1 and near 2 or better if possible).

4. Initially a liquid having low vapor pressure, low viscosity at room temperature, low freezing point, and high boiling point.

5. Polymerized to a solid via heat and/or catalyst. Should have long pot life, no reaction with a wide variety of oxidizers, and have low shrinkage and evolve no volatiles on cure.

6. Excellent binder at high oxidizer loadings. Binder should allow grain to be cycled over range of —80 to 180° F. Should be moisture resistant and have good high-temperature stability and shelf life.

7. Low in cost and readily available. Of course, the propellant should burn (and smoothly), ignite easily at cold temperatures, and have good stability at high temperatures.

Some of the other practical plastics requirements (12) include:

1. Brittle point lower than the lowest anticipated grain temperature.

2. Low elongation for internal burning grain configurations.

3. Resistance to plastic flow.

Thermosets vs. thermoplastics

The early trend in plastics for fuel-binders was away from the thermoplastics to the thermosets (polyester, polysulfide, and polyurethane). Gradually, some thermoplastics have come into use, such as PVC plastisols. As long as the ballistic, physical, and chemical requirements are met, the question as to which should be used is economic. Such polymers as polyethylene (this ranks high in heat of combustion according to Table I), polypropylene, polycarbonates, polyaldehydes, and polyamides are promising thermoplastics.

FIG. 5: Burning of propellant strand composed of ammonium nitrate and plastic fuel-binder. Note decomposing and burning plastic fuel "streamers" in strand measuring ¼ by ¼ inch. Also note "pockets" on surface.

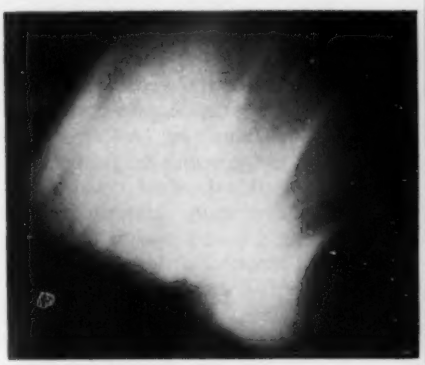

FIG. 6: Oblique view of solid propellant strand that is composed of ammonium perchlorate oxidizer and PVC plastisol fuel-binder. Strand is 0.1-in. thick and ¼ in. wide. Note the intense "streamers" at top.

Processing

Given suitable ballistic performance the choice of a plastic is likely to go to one that yields a system that is easily **(To page 350)**

Vinyl plasticizers: solvating power versus structure

By W. J. Frissell*

Vinyl resins of the high-molecular-weight type used in flexible vinyl compounds require high temperatures and/or high shear rates for fusion. The solvating power of a plasticizer refers to its ability to reduce the required temperature or shear rate. Plasticizers differ markedly in solvating power. A number of tests have been devised to measure this property; one of the simplest and most useful of these is the minimum fluxing temperature. This is the temperature at which a resin-plasticizer mixture develops a minimum tensile strength under certain fixed conditions.

The minimum fluxing temperature test has been used to study the solvating power of a large number of commercial and experimental plasticizers. These data have been analyzed to determine the effects of various molecular structures on solvating power. Conclusions have been drawn concerning the relative importance of various structural groups; these observations should be useful in the design of new plasticizer molecules and in explaining the behavior of existing plasticizers.

A minimum fluxing temperature test for plasticizer-resin mixtures was described by McKenna (1)[1]. This test measures the temperature at which a plastisol develops the tensile strength necessary for cohesion. The test used to obtain the data reported in this article differs somewhat in detail from that of McKenna, and was developed in 1951 by Jebens (2).

An iron bar about 1 in. thick, 3 in. wide, and 18 in. long is heated at one end so that a temperature gradient of 50 to 160° C. is produced on its surface. This surface is lightly lubricated with silicone stopcock grease. A plastisol, consisting of 100 parts QYNV resin,[2] 100 parts plasticizer, and 1.0 part of dibutyl tin dilaurate, is mixed in a beaker. It is then poured out along the bar in a uniform stream about ¼ in. wide. After 20 min. the hot end of the strip is grasped and is gently and steadily pulled away from the bar, maintaining the fused strip at right angles to the bar. The strip will break at the point where fusion is not quite sufficient for cohesion to have developed. The temperature at this point is measured with a contact pyrometer and is called the minimum fluxing temperature. The test is used in this work as a measure of plasticizer solvating power.

In the development of the minimum fluxing temperature test, a duration of 20 min. was chosen more or less arbitrarily. Table I, below, shows data at 5, 10, 20, and 40 min. duration for several different types of plasticizers. All of the more highly solvating plasticizers are insensitive to test duration. The plasticizers with values above 130° C. show a marked drop in minimum fluxing temperature with longer test times, except for one of the polyesters, Santicizer 409. It is concluded that plasticizers low in solvating power are more likely to require longer fusion cycles as well as higher fusion temperatures.

Table II, p. 234, lists minimum fluxing temperatures for a large number of commercial and experimental plasticizers. The plasticizers are classified by ester type.

Solvating power

By analysis and cross-comparison of minimum fluxing temperatures, an order of solvating power for various changes in molecular structure has been derived. The scale used is the number of degrees C. by which the indicated change

Table I: Effect of test duration on minimum fluxing temperature of plasticizers

Plasticizer	*Minimum fluxing temperature at various test times*			
	5 min.	*10 min.*	*20 min.*	*40 min.*
	°C.	°C.	°C.	°C.
Di-*n*-butyl phthalate	67	65	67	68
Di-2-ethylhexyl phthalate	106	106	105	104
Di-isodecyl phthalate	125	128	125	124
Tricresyl phosphate	82	82	83	84
2-Ethylhexyl diphenyl phosphate	74	75	75	76
Polyethylene glycol di-2-ethylhexoate	139	144	133	128
Di-isodecyl adipate	154	154	150	140
Soybean oil epoxide	128	128	126	126
Isooctyl epoxy stearate	136	136	129	120
Polyesters				
Santicizer 409	141	139	140	140
Plastolein 9720	134	136	132	127

*Technical Service Laboratory, Union Carbide Chemicals Co.
[1]Numbers in parentheses designate references at end of article, p. 238.
[2]Bakelite Resin QYNV, U.C. Plastics Co.

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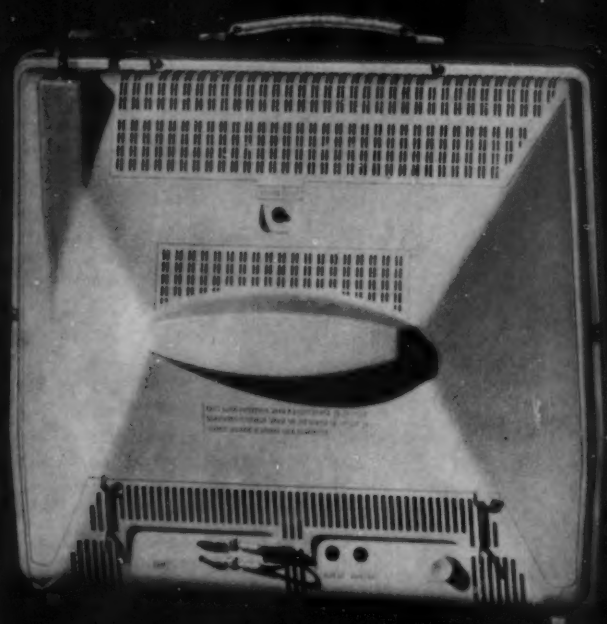

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Table II: Minimum fluxing temperatures of plasticizers

Plasticizers	Min. fluxing temp. °C.
Phthalate esters	
Ethyl	54
n-Butyl	68
Isohexyl	87
2-Ethylhexyl	105
Isononyl	122
Isodecyl	124
Isoundecyl	136
Isotridecyl	155
Capryl	106
2-Propylheptyl	133
n-Hexyl	75
Butyl/2-ethylhexyl 20/80	94
2-Ethylhexyl/isodecyl 40/60	111
Isohexyl/isodecyl 100/80	106
2-Methylpentyl/isodecyl 50/50	110
Butyl/cyclohexyl	68
Butyl/benzyl	75
n-Octyl/*n*-decyl 2/1	110
Isophthalate esters	
2-Ethylhexyl	123
Isodecyl	152
Isononyl	142
Butyl/2-ethylhexyl 20/80	117
2-Ethylhexyl/isodecyl 47/53	140
Hexahydrophthalate esters	
2-Ethylhexyl	112
Isodecyl	145
Hexahydroisophthalate esters	
2-Ethylhexyl	123
2-Ethylhexyl/isodecyl 47/53	132
Terephthalate esters	
2-Ethylhexyl	135
Adipate esters	
Isodecyl	148
2-Ethylhexyl	120
Isononyl	138
Azelate esters	
2-Ethylhexyl	145
Sebacate esters	
Benzyl	103
2-Ethylhexyl	152
Butyl	102
Isosebacate esters	
2-Ethylhexyl	155
Phosphate esters	
Tricresyl	78
Cresyl diphenyl	78
2-Ethylhexyl diphenyl	71
Didecyl cresyl	107
Di-2-ethylhexyl phenyl	86
Tri-2-ethylhexyl	110
Tri-*n*-butyl	48
Polyesters	
Morflex P-50	153
Admex 761	135
NP-10	135
Harflex 300	134
Plastolein 9720	132
Paraplex G-53	143
"Flexol" R2H	147
Aroplaz 2559	147
Paraplex G-54	138
Harflex 325	144
Santicizer 409	142
Harflex 330	144
Butanetricarboxylic acid esters	
2-Ethylhexyl	150
2-Ethylhexyl/2-methylpentyl 2/1	143
2-Ethylhexyl/2-methylpentyl 1/2	132
2-Ethylhexyl/isobutyl 2/1	135
Cyclohexyl/isodecyl 1/2	150
Cyclohexyl/2-ethylhexyl 1/2	125
Cyclohexyl/2-ethylhexyl 2/1	101
Cyclohexyl/isobutyl 1/2	85
Cyclohexyl/isobutyl 2/1	75
Dibenzoate esters	
Diethylene glycol	72
Dipropylene glycol	78
Polyethylene glycol	82
Octylene glycol	86
3-Methyl-1,5-pentanediol	72
Monobasic acid esters	
Octyl palmitate	165
Butyl stearate	156
Epoxytetrahydrophthalate esters	
2-Ethylhexyl	100
Isodecyl	120
Epoxystearate esters	
Butyl	98
n-Hexyl	113
Isooctyl	128
2-Ethylhexyl	125
Amide esters of diethanolamine	
Isopentanoic	71
Isohexanoic	90
2-Ethylhexoic	119
Pelargonic	120
Isooctoic	115
Citrate esters	
Acetyl tributyl	102
Acetyl tri-2-ethylhexyl	165
Glycol esters	
Triethylene glycol dihexoate	110
Triethylene glycol di-2-ethylhexoate	132
Polyethylene glycol di-2-ethylhexoate	132
Diethylene glycol dipelargonate	136
Chlorinated paraffins	
40% chlorine	135
50% chlorine	120
60% chlorine	76
70% chlorine	84

in structure changes the minimum fluxing temperature. That structural change producing the greatest drop is, of course, the one of highest solvating power and is shown at the top of the table. Some structural changes actually have a negative effect on solvating power, that is, they raise the minimum fluxing temperature. These are at the bottom of the table. It must be understood that these are not absolute values but may be different at higher or lower molecular weight levels. The data in this table were almost all derived from esters in the range of 22 to 26 carbon atoms (molecular weight range about 330 to 430). It is safest to consider Table III, p. 236, as a ranking or semi-quantitative listing.

Effect of alkyl chain length

Variation in the length of an alkyl chain, in either the alcohol or acid portion of an ester, is the most frequent structural variation. Data were available for two or more members of each of 14 different ester types. The data were plotted for each type as minimum fluxing temperature vs. number of acyclic carbon atoms (or CH_2 groups) in the molecule. The straight line, obtained in all cases, varied in slope from 5.0 to 8.0° C. per acyclic carbon. As an example, the plot for dialkyl phthalates is shown in Fig. 1, p. 236. If the slope is rounded off to the nearest whole number, the ester types can be divided into three classes having slopes of 5.0, 6.0, and 8.0, respectively, as shown by the data in Table IV, p. 238.

There is no apparent explanation for these differences or for the grouping of ester types. However, all of the slopes are positive, which means that the addition of a CH_2 group raises the minimum fluxing temperature or reduces the solvating power. In the following section, specific use will be made of these data to adjust for differences in number of CH_2 groups, so that more exact assessments of other structural features may be made.

Other structural features

If a comparison is made of two plasticizer molecules that are essentially the same in molecular weight, but differ in some important structural feature, the differ-

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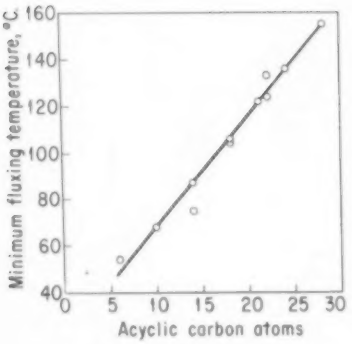

FIG. 1: Minimum fluxing temperature versus the number of acyclic carbon atoms in di-alkyl phthalates.

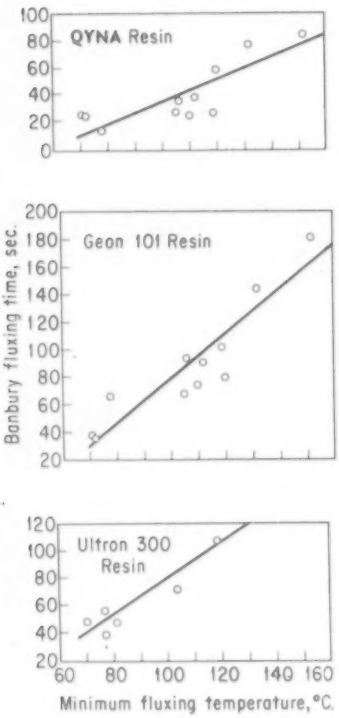

FIG. 2: Banbury fluxing time versus minimum fluxing temperature for three different resin-plasticizer mixtures.

ence in their minimum fluxing temperatures is a measure of the effect of the structural feature. Table III was derived using this method. The detailed comparisons are as follows:

A comparison of di-2-ethylhexyl phthalate and di-2-ethylhexyl azelate will show the effect of substituting an aromatic ring for a chain. For DOP, minimum fluxing temperature is 105° C.; for DOZ, 145° C. DOZ has one more CH_2 group, so to correct for this difference, 6 degrees must be subtracted: 145—6 = 139. Then: 139—105 = 34°. Thus, 34° is the drop due to changing from a chain to an aromatic ring.

The effect of replacing a chain with a saturated ring may be found by comparing DOZ and di-2-ethylhexyl hexahydrophthalate, CC-55. The value for DOZ, corrected to the same number of carbon atoms (as above) is 139° C. That for CC-55 is 112° C. 139—112 = 27° drop.

The addition of an epoxy oxygen to a saturated ring may be evaluated by comparing CC-55 (112° C.) with di-2-ethylhexyl epoxytetrahydrophthalate (100° C.) 112—100 = 12° drop.

A comparison of butyl stearate (156° C.) and butyl epoxystearate (98° C.) shows the effect of adding a single epoxy oxygen to an aliphatic mono-ester. 156—98 = 58° drop.

The addition of a third ester linkage to an aliphatic di-ester comes from comparing di-2-ethylhexyl sebacate, DOS (152° C.), with the di-2-methylpentyl mono-2-ethylhexyl ester of butanetricarboxylic acid (132° C.). To adjust the latter to the same number of carbon atoms as DOS, *i.e.*, 26, we must subtract 5°: 132—5 = 127. Then: 152—127 = 25° drop.

The addition of an amide linkage to an aliphatic di-ester may be evaluated by comparing di-2-ethylhexyl adipate, A-26 (120° C.) to the amide di-ester of hexanoic acid and diethanolamine, 6N6 (90° C.). 120—90 = 30° drop.

A comparison of butyl stearate (156° C.) and di-2-ethylhexyl adipate (120° C.) shows the effect of adding an ester linkage to an aliphatic mono-ester. 156—120 = 36° drop.

The addition of a fourth ester linkage to an aliphatic tri-ester is shown by comparing pentaerythritol tetra-2-methylpentanoate (148° C.) and the di-2-ethylhexyl mono-2-methylpentyl ester of butanetricarboxylic acid (143° C.). 148—143 = 5° *rise*. The addition of the fourth ester linkage actually reduces solvating power.

The addition of an etheric oxygen in a carbon chain is shown by comparing 3-methyl-1,5-pentanediol dibenzoate (72° C.) and dipropylene glycol dibenzoate (78° C.). 78—72 = 6° *rise*. This is essentially the same thing as if one were to lengthen the chain by one CH_2 group.

When these effects of various changes in structure are arranged in order of magnitude, we get the "order of solvating power" that is illustrated by the data in Table III. The numerical values, however, are not absolute. If a specific comparison is made at a higher or lower molecular weight, the value will be different. Usually differences will be greater at higher minimum fluxing temperatures. As a result, the data must be applied in a semi-quantitative manner.

One of the more interesting, and somewhat discouraging conclusions to be drawn for the ranking of structural changes by solvating power is that the addition of successive functional, or polar, groups is decreasingly effective. We have a sort of "law of diminishing returns." The addition of ester link-

Table III: Decreasing order of solvating power of plasticizers

Structural-change	*Change in min. fluxing temp.* °C.
1. Add single epoxy oxygen to aliphatic mono-ester	−58
2. Add second ester linkage in aliphatic mono-ester	−36
3. Replace chain with aromatic ring	−34
4. Add amide linkage in aliphatic di-ester	−30
5. Replace chain with cyclohexane ring	−27
6. Add third ester linkage in aliphatic di-ester	−25
7. Add epoxy oxygen to cyclohexane ring	−12
8. Add fourth ester linkage to aliphatic tri-ester	+ 5
9. Add etheric oxygen into chain	+ 6
10. Add CH_2 group to chain	+5 to + 8

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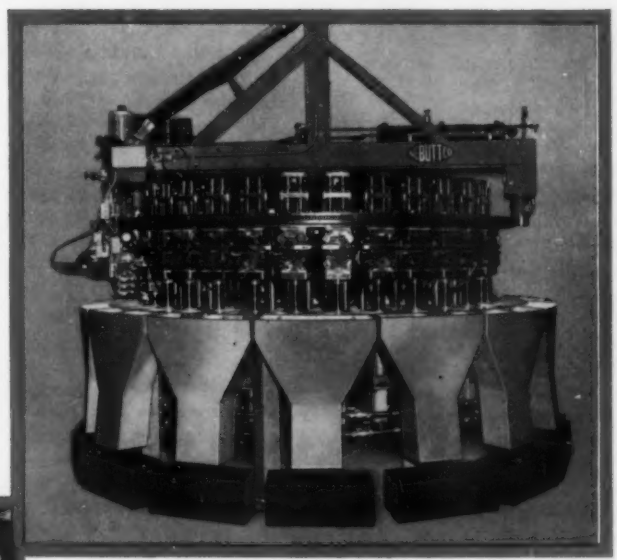
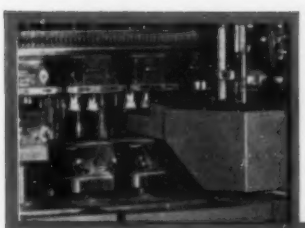
Molds Thermosetting Closures FAST





Molds are progressively opened, charged with compound, and closed under pressure for curing as feeding arm revolves around machine.

Cam-actuated rotating wheel automatically unscrews closures as molding cycle is completed.

NEBUTTCO

The thirty stations on this Nebuttco Rotary Press provide high speed, continuous molding of large or small quantities using any free-flowing thermosetting compound in low cost, single or double cavity molds. Providing the closures are the same color and similar in section, as many as three different molds can be used in the machine at one time.

The compound is hopper-fed, and precision metered through the rotating feeder arm. Machine eliminates sorting problems, because stations eject parts into separate metal chutes. Production cycle can be varied and the temperature in the mold holders can be individually adjusted if required.

The machine is available in one model — the thirty-station press illustrated. This machine is easy to install and maintain, and is adaptable for many applications.

For more information please contact

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ages to an aliphatic mono-ester will illustrate the following:

Add second ester linkage	36° drop
Add third ester linkage	25° drop
Add fourth ester linkage	5° rise

There are certainly many secondary effects that have been passed over. There is some evidence that degree of chain branching has a minor effect on solvating power. Different spatial arrangements may be very important. An outstanding example of the latter is found among the di-2-ethylhexyl esters of the three isomers of phthalic acid.

Di-2-ethylhexyl ester	*Min. fluxing temp., °C*
Ortho-phthalate	105
Iso-phthalate	123
Tere-phthalate	135

Values are shown in the table of minimum fluxing temperatures for a number of polyesters. Analysis of these data is severely hampered by a lack of information on composition and molecular weight of these plasticizers. However, one observation can be made: they are all high in minimum fluxing temperature, ranging from 132 to 153° C. They are all believed to be made from aliphatic diols and dibasic acids. Thus, they resemble the monomeric esters of similar type, the aliphatic dibasic esters, in having relatively poor solvating power.

Results are available on liquid chlorinated paraffins of 40, 50, 60, and 70% chlorine content. It is interesting that the lowest minimum fluxing temperature occurs at 60% chlorine. This is very close to the chlorine content of polyvinyl chloride resin, which is 57 percent.

Table IV: Classification of ester-type plasticizers on basis of effect of alkyl chain length on minimum fluxing temperature

Ester type	*°C./CH_2 group*
Alkyl phthalates	5.0
Butanetricarboxylic acid esters	
Citrate esters	
Tri-alkyl phosphates	
Amide di-esters	
Glycol dibenzoates	
Aliphatic dibasic esters	6.0
Glycol di-alkylates	
Aliphatic mono-esters	
Alkyl hexahydrophthalates	8.0
Alkyl isophthalates	
Alkyl epoxytetrahydrophthalates	
Alkyl epoxystearates	
Alkanediol dibenzoates	

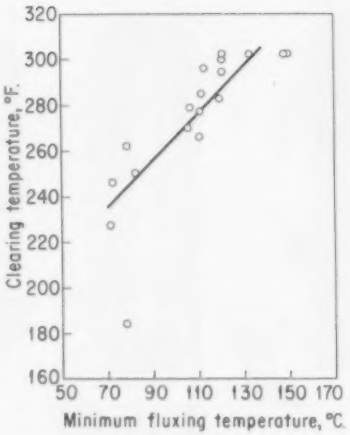

FIG. 3: Clearing temperature versus minimum fluxing temperature for QYNV resin-plasticizer mixture.

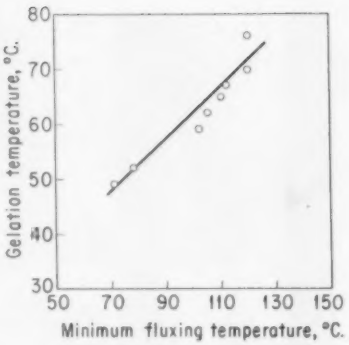

FIG. 4: Gelation temperature vs. minimum fluxing temperature for resin-plasticizer mixture.

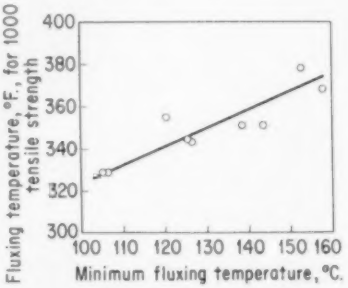

FIG. 5: Fluxing temperature to give 1000 p.s.i. tensile strength vs. minimum fluxing temperature for resin-plasticizer mixture.

Correlation with other tests

A Banbury fluxing time test has been reported in the literature and also has been used in this laboratory. Plots of Banbury fluxing times against minimum fluxing temperatures are shown for three different resins in Fig. 2, p. 236. The data in Fig. 2 for Ultron 300 resin are from Bergen and Darby (3). The correlation is good in all three cases.

The clearing temperature of a solution of 4% QYNV resin in plasticizer was studied for a series of plasticizers by Severs and Smitmans (4). Results are plotted against minimum fluxing temperature in Fig. 3, above. A definite correlation is evident.

Todd, Esarove, and Smith (5) reported viscosity-temperature data on plastisols containing different plasticizers. A viscosity of 30,000 poises has been selected and the temperature at this viscosity called the gelation temperature. This is plotted against minimum fluxing temperature for eight plasticizers in Fig. 4, above. This correlation is also quite satisfactory.

Coe (6) reported the fluxing temperatures required to achieve selected tensile strengths in plastisols for a number of plasticizers. The data for a tensile strength of 1000 p.s.i. are plotted against minimum fluxing temperature in Fig. 5, above. A correlation is also evident.

It is apparent that the minimum fluxing temperature is related to several other measures of fluxing and gelation phenomena. All of these tests are means of measuring "solvating power."

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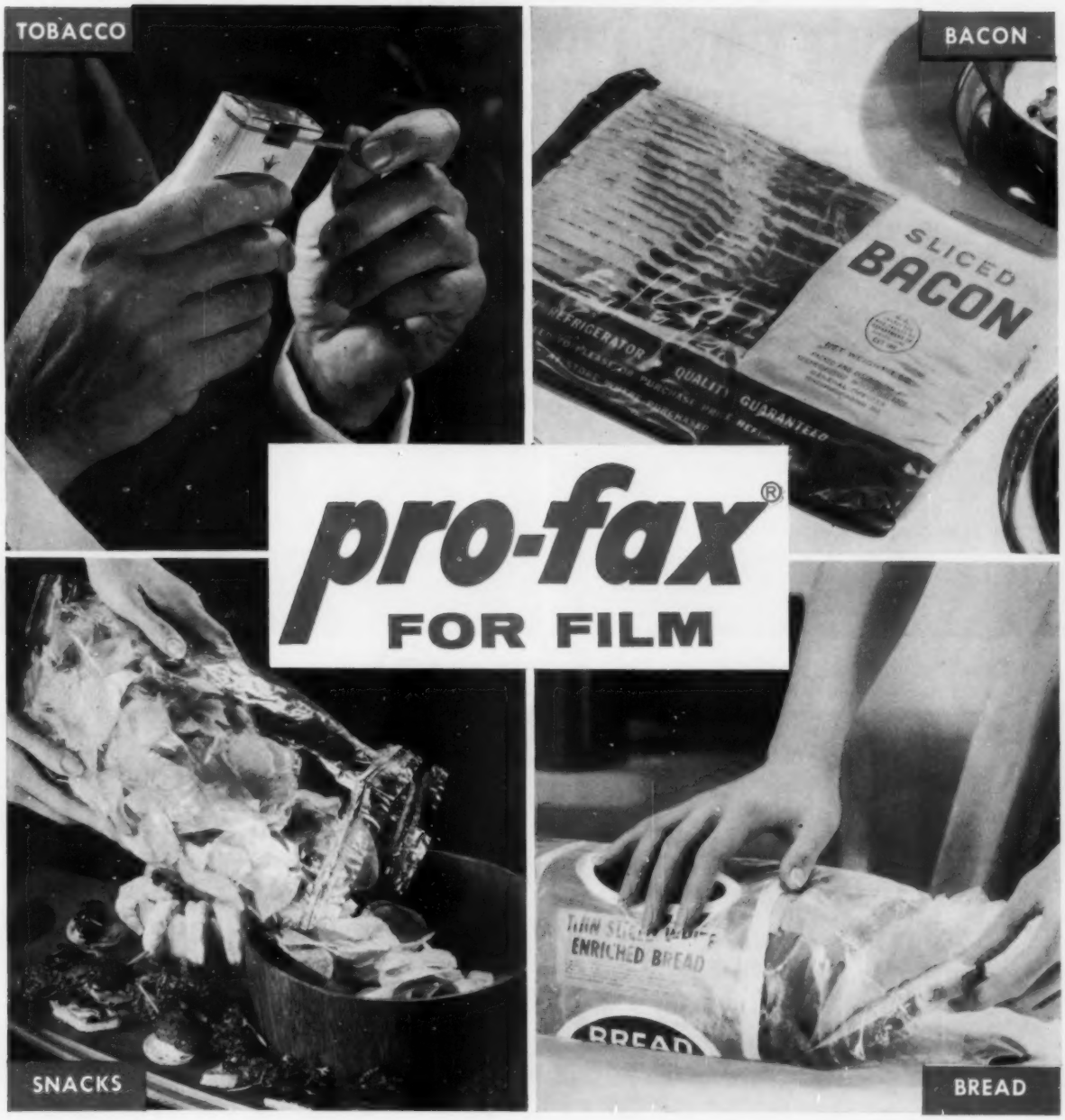

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Adsorption of polymers on glass and other substrates—Part II

By R. R. Stromberg* and G. M. Kline*

Part I, published in the April issue, dealt with the 1) rate of adsorption, 2) nature of adsorbent surface, 3) effect of solvent, and 4) effect of molecular weight of polymer in adsorption of polymers onto glass, silica, alumina, and other adsorbents. This concluding part deals with temperature effects, adsorption-desorption reversibility, and configuration of the adsorbate molecule. Theoretical expressions derived to account for adsorption behavior of polymers and their significance in practice are discussed.

Adsorption-desorption reversibility

In studies of the reversibility of polymer-solvent adsorption systems, polymer solution was added to the adsorbent powder, and adsorption determinations carried out in the manner described earlier. Part of the solution was then removed and replaced with solvent, and the tubes were sealed and rotated at constant temperature for several days. Figure 12, right, (1a)[1] shows the results obtained for poly(neopentyl succinate) on Type E glass. No desorption was observed when attempts were made to remove polymer with the same solvent that was used for the adsorption. This occurred whether the adsorption was carried out from a poor or good solvent. This effect is similar to that described by Yeh and Frisch (5) who observed that poor solvent did not remove polymer adsorbed from it, and by Frisch, Hellman, and Lundberg (11) who observed that polystyrene adsorption appeared to be irreversible for time intervals up to two weeks in Soxhlet extractors.

For desorption to occur it is necessary that all portions of the molecule in contact with the surface be removed. It is possible that fewer contacts exist after the desorption experiment, but that a sufficient number per molecule remain to keep the chain adsorbed.

Desorption may occur, but the rate is too slow to be observed in our experiments, which covered only several days.

However, if a good solvent (in this case chloroform) is used to desorb polymer that had been adsorbed from a poor solvent (toluene) desorption is observed, with the curve falling in-between. This curve, which is for a mixed chloroform-toluene system, is not shown, but it coincided essentially with the 87° C. curve in Fig. 12.

In the case of adsorption of polyesters onto silica, desorption did occur with the same solvent. This desorption is shown in Fig. 13, p. 242. The curve for the adsorption of poly(ethylene-*o*-phthalate) on silica at 30° C. is shown by the solid curve. A closed circle represents the amount still adsorbed after a desorption experiment in a particular tube for which the original adorption is indicated by the open circle connected to it by a dashed line. The ease of desorption from silica and the lack of desorption from glass with the same solvent indicates a different type or strength of bond, with a much stronger bond to glass.

Effect of temperature

Figure 12 shows the effect of temperature on adsorption of poly (neopentyl succinate) on glass;

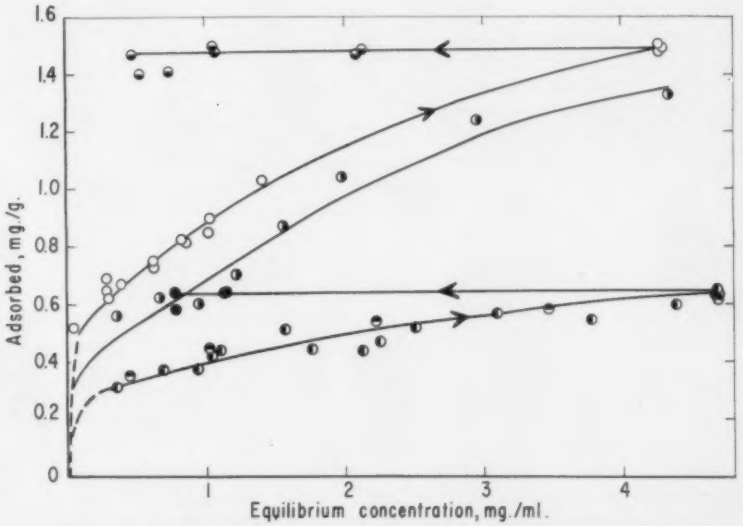


FIG. 12: Adsorption and desorption of poly(neopentyl succinate) on Type E glass, Reference 1a. ○ Adsorption from toluene at 30° C.; ◒ desorption with toluene at 30° C.; ◑ adsorption from toluene at 87° C.; ◐ adsorption from chloroform at 30° C.; ● desorption with chloroform at 30° C.; ◓ adsorption from chloroform at 50° C.

*National Bureau of Standards, Washington 25, D. C.
A portion of the research reported in this article was performed as part of a project sponsored by the Bureau of Naval Weapons. The article was presented at the IUPAC Symposium of the 12th International Congress on Plastics in Torino, Italy, Sept. 28, 1960.
[1]Numbers in parentheses designate references at end of article, p. 356, or in Part I, MPI, April 1961, pp. 195-196.

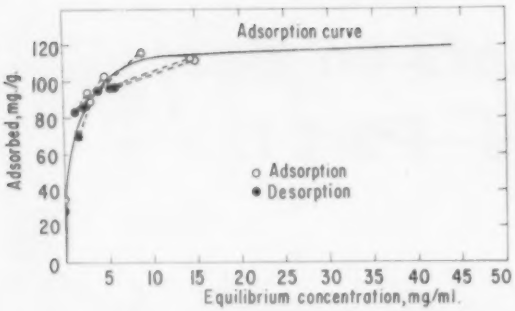


FIG. 13: Adsorption and desorption of poly(ethylene *o*-phthalate) from chloroform solution on silica at 30° C.

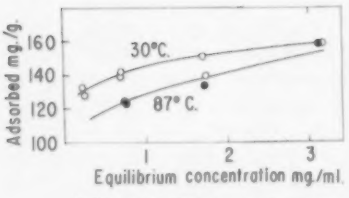


FIG. 14: Effect of temperature on adsorption of poly(neopentyl succinate) from toluene solution onto silica.

there is less adsorption at 87° than at 30° C. when toluene is the solvent, and the two isotherms are roughly parallel. In the case of chloroform, however, there is no observable difference in the isotherm at temperatures of 30 and 50° C. Similar results were obtained during the tests with the silica adsorbent. Figure 14, above, illustrates the difference in isotherms at temperatures of 30 and 87° C. for the polyester poly(neopentyl succinate) when adsorbed from toluene onto silica.

This decrease in the quantity of polymer adsorbed at the elevated temperature from toluene is probably due, in part, to the increased solubility of the polymer in the poor solvent at the elevated temperature. In addition, it is also reasonable to expect that the polymer exists in the toluene at 87° C. as a more open coil than at 30° C.; therefore, fewer molecules could be accommodated by the available surface area at the elevated temperature. This increase in size could not be proved for polyester molecules; the intrinsic viscosity measurements were essentially the same at both temperatures. Such an explanation is more likely valid for very large polymers which have a more coiled configuration in solution than these polyesters.

The effect of temperature on desorption of poly(neopentyl succinate) from Type E glass is shown in Fig. 15, p. 245. The solid curves for adsorption of this polyester from a toluene solution onto the glass are the same as those shown in Fig. 12. In a duplicate set of tubes the polymer was initially adsorbed at 30° C. and then the tube containing the adsorbent-solution mixture was transferred unopened to a bath at 87° C. After approximately two days at this elevated temperature, the solution was analyzed and the results are shown by the open circles. It is apparent from these data that most of these points fall between the 30 and 87° C. curves, but nearer to the 87° C. curve.

A dashed curve is shown for these points; there is a considerable amount of scatter. Another set of tubes was run through a 30 to 87 to 30° C. cycle; a curve that is very close to the 30 to 87° C. curves is obtained. There is probably no significant difference between the temperature range of 30 to 87° C. and 30 to 87 to 30° C. curves.

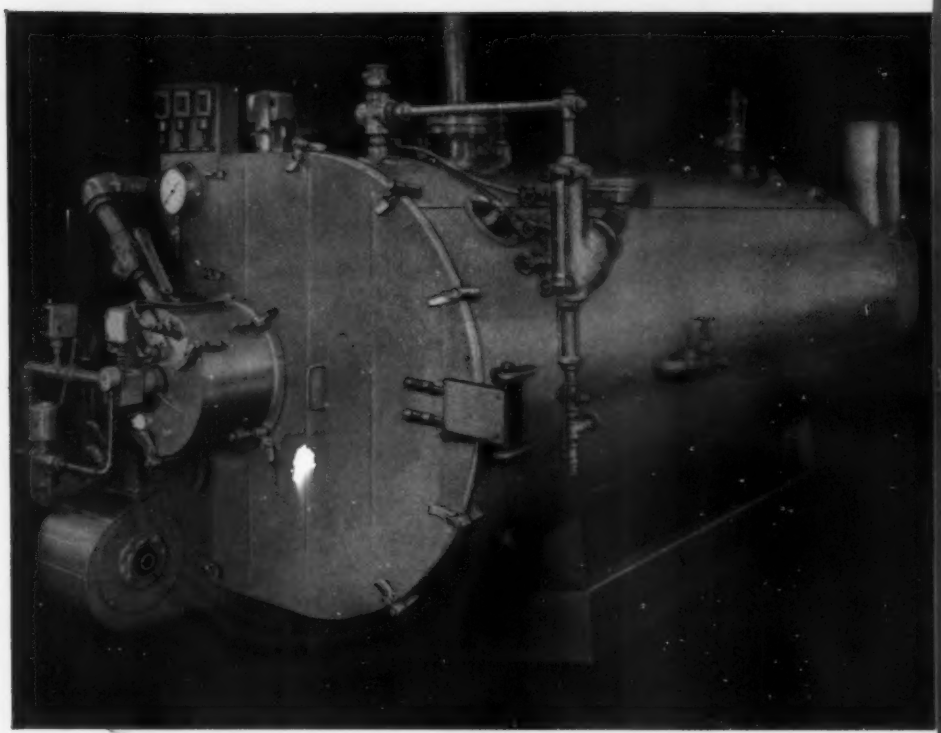
Thus, in the case of adsorption of this polyester from toluene onto glass, it is possible to desorb by increasing the temperature. The desorption can be the result of the difference in solubility at the two temperatures. It will be recalled that a good solvent, chloroform, desorbed polymer that had been adsorbed from the poor solvent, toluene, although it was not possible to desorb from glass with toluene, when adsorption was carried out from this same solvent. The toluene at 87° C. is a much better solvent than toluene at 30° C. It also appears that once the surface is occupied at the higher temperature, there is no more space for additional adsorption. Absence of readsorption could be the result of a blocking of adsorption sites by molecules that are extended at the higher temperature.

Conformation of polymer molecule at interface

Evidence based on the solution properties of polymers and statistical considerations (2, 9, 18, 19) indicates that the polymer molecule probably is attached to the adsorbent at several places along the chain, with loops extending into the solution. The sizes of these loops, their extension or compression, and the radius of gyration of the molecule in solution compared to that in the adsorbed state have not been evaluated.

The polyesters studied are relatively small molecules. The area of a segment of poly(neopentyl succinate) has been determined from film balance measurements to be of the order of 70 A.[2] If the molecules were to lie flat, there would be on glass approximately 5 layers after adsorption from toluene and approximately 2.2 layers from chloroform. There would be about a monolayer of this polymer adsorbed on silica. It is apparent that only relatively small loops extend into the solution in the case of the polyesters (1a). In the case of larger molecules, however, such assumptions yield 10 to 40 molecular layers of material (2). It is apparent that these loops are much more extensive.

Gottlieb (10) studied the change in surface potential of adsorbed molecules as a function of the quantity adsorbed. He found that the surface potential—surface coverage curve for poly(vinyl acetate) on metal was identical to such a curve for octadecyl acetate. At a point where the maximum amount of octadecyl acetate was adsorbed, the polymer plot became horizontal with no further changes in surface potential with additional adsorption. He concluded that at surface coverages below the plateau, the acetate groups of the polymer were oriented towards the metal surface in the same manner as the independent ester groups of the small molecule. After the surface has been essentially covered with a monolayer, additional molecules are attached at only a few points, with the bulk of these molecules extending into the solution in a coiled



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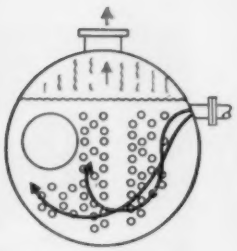

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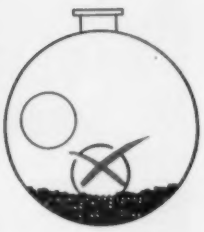

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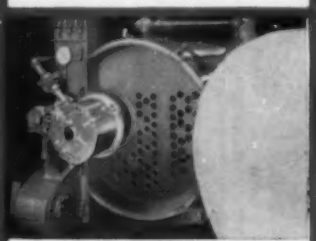

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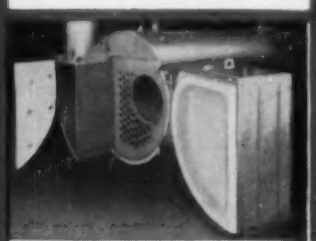

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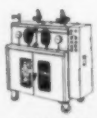
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conformation. This view of the conformation is, of course, quite different from that of the coiled molecules, each of which is attached at several or many sites, all extending into the solution.

No direct measurements of the thickness of a polymer layer at the solid-liquid interface have been made. Some estimates have been made by indirect methods. Öhrn (20) measured the viscosity of polystyrene, M ~ 500,000, in capillaries of two different diameters and attributed the greater reduced viscosity observed in the narrower capillary to a decrease in capillary diameter resulting from adsorbed polymer. He computed a maximum thickness of about 1500 A. Polystyrene of this molecular weight has an end to end distance of about 660 A. (2), corresponding to a radius of gyration of about 270 A. If the value of 1500 A. for the thickness is valid, it appears that multilayers are formed. It is also possible that lateral compression of the large polymer molecules during or subsequent to adsorption contributes to the thickness. In those systems in which desorption does not readily occur, it is possible that the adsorbed chains are laterally compressed, freeing previously blocked sites for adsorption by other interpenetrating molecules, resulting in thickness that measures as much as three times the normal diameter of the molecule.

Hugue, Fishman, and Goring (21) conducted very low concentration capillary viscometry measurements on cellulose nitrate similar to those of Öhrn on polystyrene. They calculated the thickness of the adsorbed layer to be between 500 and 1000 A. for material with a $\overline{M}_w$ of 2.2×10^6 and a radius of gyration of 1600 A.

Applicability of existing theories

Several theoretical and empirical isotherms have been derived or devised to describe adsorption results. A well-known equation that is very frequently applied to the adsorption of small molecules as monolayers is that of Langmuir (22):

$$\theta = \frac{k_1 k_2 c}{1 + k_1 c} \qquad \text{Eq. 1}$$

where θ is the fraction of surface covered, c is the concentration, and k_1 and k_2 are constants. Equation 1 can be rearranged as follows:

$$\frac{c}{\theta} = \frac{1}{k_1 k_2} + \frac{c}{k_2} \qquad \text{Eq. 2}$$

Figure 16, below, presents a plot of c/a (a, the specific amount adsorbed, is proportional to θ) versus c for the adsorption of poly(methyl methacrylate) on Type E glass. There appears to be agreement with the Langmuir equation. However, as pointed out by others (2), Eq. 1 can also be rearranged as:

$$\frac{1}{\theta} = \frac{1}{ck_1 k_2} + \frac{1}{k_2} \qquad \text{Eq. 3}$$

Curve B of Fig. 16 presents a plot of $1/a$ versus $1/c$, which indicates that the low concentration range is not linear.

Of course, one should not expect that the Langmuir equation would necessarily apply to high polymer adsorption. This isotherm is based on thermodynamic reversibility, which may not apply to many polymer-adsorbent systems within reasonable time limits. Secondly, the isotherm was derived on the basis of "hard spheres" which do not interact or change shape. This does not appear to be valid for polymer chains which very well may interact or compress on adsorption.

Isotherms have been derived by Simha, et al., and by **(To page 353)**

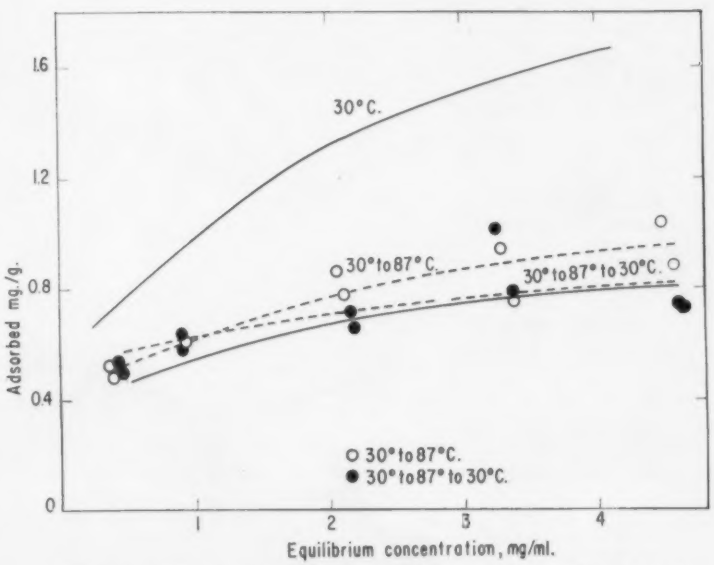

FIG. 15: Effect of temperature cycles on the adsorption of poly(neopentyl succinate) from toluene solution onto Type E glass.

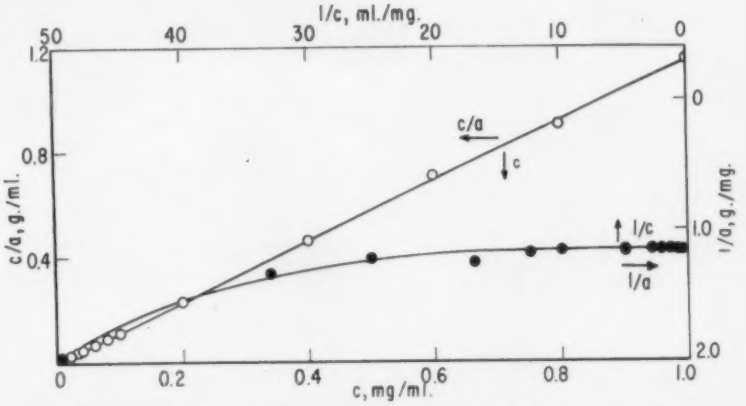

FIG. 16: Plots of the Langmuir isotherm for the adsorption of poly(methyl methacrylate) from toluene onto Type E glass at 30° C.

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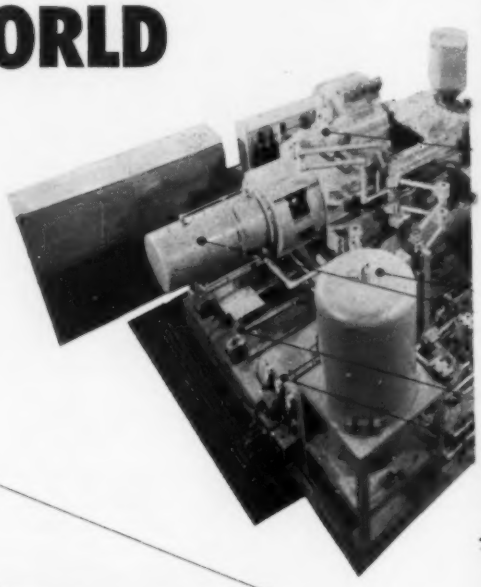

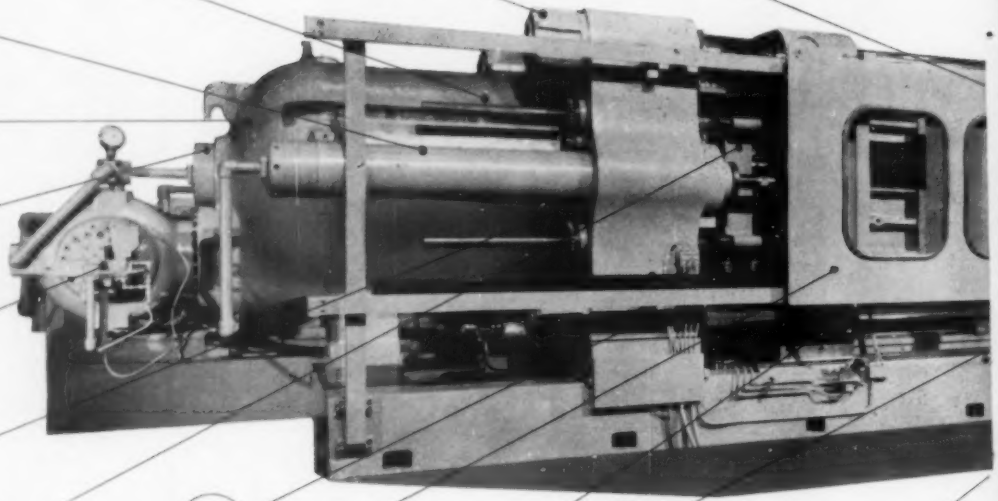

32 Deflection-free, large stationary Platen

31 Buttless Nut, non-loosening

30 Rugged Screw Rod to control Ejector Stroke

29 Independent pull-back Cylinder

28 Powerful U.S. 2500-ton Clamping Cylinder

27 Booster Ram for High Speed Die Closing

26 Oil-operated 12" Surge Valve, with Automatic Control

25 Simultaneous Adjustment Device for Ejector Rods

24 Incorporated Hydraulic Ejector

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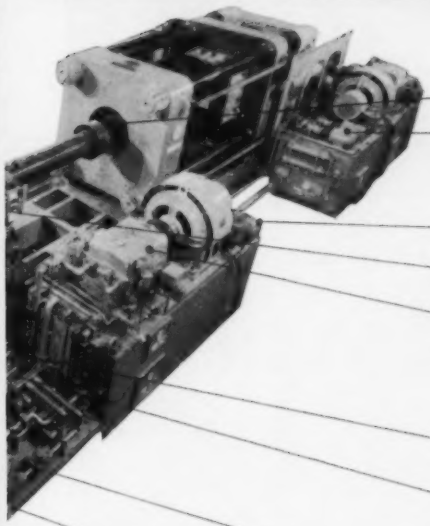
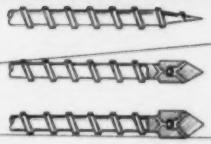
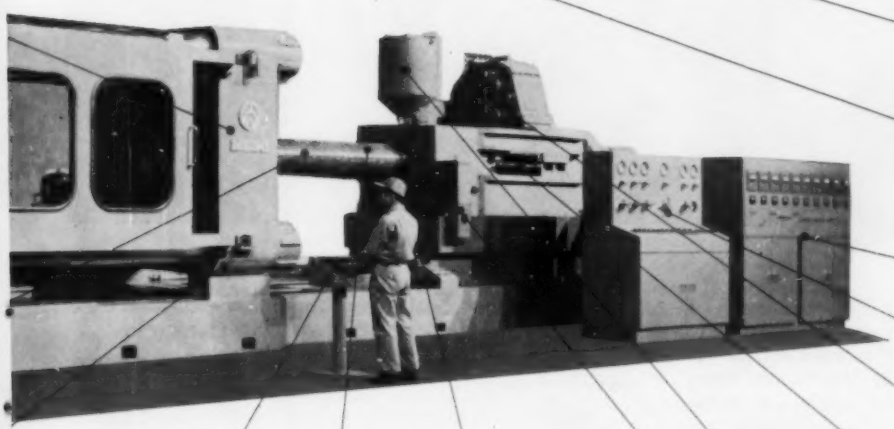




1. Three Exchangeable Screw Heads
2. 3300 psi High Pressure Pump, 2 sets
3. 3000 psi Pump for Shifting and Turning of Injection Unit
4. Oilgear Hydraulic Motor Stepless Speed
5. Oilgear 150HP Hydraulic Pump of Variable Delivery
6. Accumulator for boosting Injection Speed
7. Precisely Horned Hydraulic Cylinder
8. Nozzle Centering can be adjusted by Ball-Surfaced Bolts
9. Flow Control Valve for regulating Injection Rate at High Speeds
10. Independent ten-zone Temperature Control Box
11. Centralized Control Box for Hydraulic Pressure and Speed
12. Case for Hardened and Ground Reduction Gears of Special Steel
13. Precise Sliding Surface for Location Mechanism



14. Small Hopper fitted with Hopper Loader
15. Hydraulic Rotating Device for Injection Unit
16. Nozzle Center Height Adjusting Device
17. Plasticizing and Injection Screw with large L/D
18. Centralized Operation Control Box

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EGAN EXTRUDERS WITH THE IMPROVED WILLERT TEMPERATURE CONTROL SYSTEM

The Egan Extruder illustrated at right is a 4½" model with 24:1 L/D ratio.

Patented

The heart of the improved Willert System is its AIR COOLED CONDENSERS, which are constructed of high pressure finned tubing and are located within the cylinder covers of the extruder. Individual zones along the cylinder are jacketed and connected to these condensers forming a closed system. Blowers are mounted in the base (see photo above) and, when in operation, remove the latent heat of vaporization. Therefore, excessive frictional heat is removed *automatically*, without thermal shock, providing uniform thermal regulation *regardless of viscosities or melt temperatures.*

The result is closer tolerance extrusions at greatly increased outputs.

Egan Extruders with the new Air Cooled Willert System are available in sizes from 2" through 12", with L/D ratios of 20:1, 24:1, 32:1.

Detailed information is available upon request.

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NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Polypropylene competes with Pyrex

What is claimed to be the largest blow-molded polypropylene bottle to date is now being produced by Nalge Co. Inc., Rochester, N. Y. The bottle is a 5-gal container designed for the preparation of batches of sterile parenteral solutions, culture media, etc.

Until the new bottle was introduced, the only bottle for this purpose on the market was made of a special heat- and break-resistant glass—which had two disadvantages: weight and breakability. The glass bottle weighs 11 lb., compared to 2½ lb. for the polypropylene model. A filled glass bottle weighed about 50 lb.; and normal handling on traditional laboratory stone tables could cause cracks (sometimes invisible) which would ultimately lead to breakage.

Nalge selected polypropylene for this application because a bottle made from the material will withstand repeated autoclaving without physical or chemical change; is safe and easy to handle—polypropylene is not slippery even when wet; has a surface that is easily cleaned; and has no effect on the contents. List price for a single bottle is $11.80 for the polypropylene bottle and $11.30 for the glass version. However, quantity cost of both is about the same.

Prospective users are pharmaceutical manufacturers and hospitals.

The bottles are blow molded by Nalge from AviSun 1014 resin on an Air-Formed Products Corp. machine. Average thickness of sidewall is ⅛ in.; bottom thickness ranges from ¼ to ⅜ inch.

Porous vinyl makes superior printing plates

Several advantages—both in quality and cost—are claimed for a new line of printing plates produced from a microporous vinyl sheet material. (For details on how the material gets its porosity, see "Microporous plastics," p. 204, MPI, April 1960.)

As made by ADS Inc., Div. of CSW Plastic Types Inc., Hartford, Conn., the new plate material is said to result in man-hour savings which probably amount to better than a one-third reduction in unit cost.

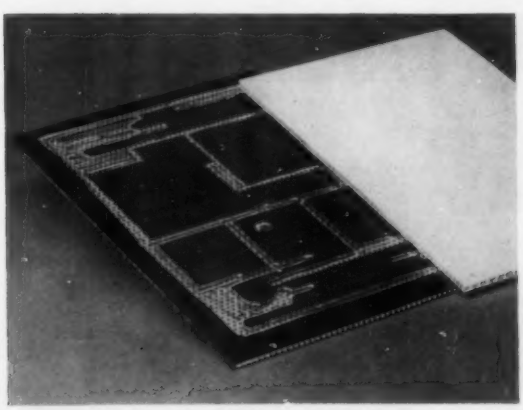
At the same time, the new plates permit easier repair of damage incurred during the printing run. To repair such batters on standard vinyl plates, the undamaged area is masked and the batter exposed to infra-red heat until recovery is achieved. Since the material used in standard vinyl plates is filled, this recovery is not always complete. The material, being porous, responds completely and rapidly to infra-red treatment.

The new thermoplastic printing plate was developed for long-run use. In carton and box printing, the plates have run for one million impressions without significant sign of wear.

The microporous blank is converted to a finished printing plate by standard methods: A rigid phenolic mold is preheated and placed in contact with the blank surface. The two are then subjected to pressure in a hydraulic press, where the impression is made on the plate. To assure fidelity in reproduction, the press is adjusted so that the bed moves up toward the platen at a constant rate, increasing the pressure uniformly. At the end of the molding cycle, the plate and mold are chilled in another press and separated. The printing plate is now ready for use, after some simple finishing operations, in a flat bed press. If the plate is to be used on rotary machines, for runs exceeding 200,000, it is faced with nylon or Delrin for improved toughness. This coating adds between 25 to 35% to the cost. To shape the plate for rotary presses, it is dipped in hot water and bent.

Sheet material for this process is supplied by Rogers Corp., Rogers, Conn., under the tradename Poron 310. Plate blanks, which are a composite of the microporous plastics sheet and perforated aluminum, are supplied by ADS under the designation E-Z Plate, and are available in supported form in 18 by 24 by 0.260 in. and in unsupported sheets, 18 by 24 by 0.110 inch.

(More on next page)



PARTIALLY FINISHED PLATE (left) shown alongside original blank. Edge of white plate shows perforated aluminum sandwiched between two pieces of PVC, which has flowed through the perforations to assure complete and permanent bond. On the plate at left, all but excess border and areas that will actually print have been routed.

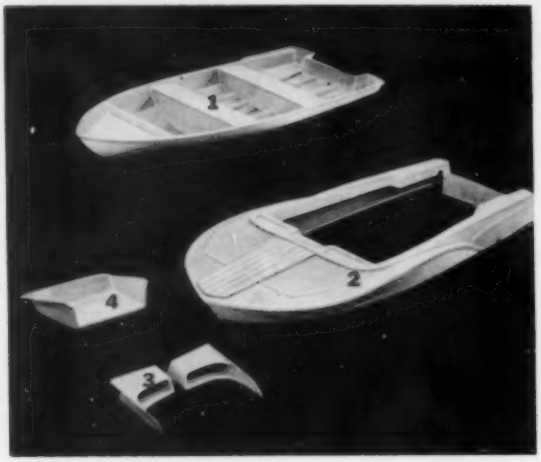
Low-cost reinforced plastics boat kits

For prospective boat owners on a budget, Luger Industries Inc., Minneapolis, Minn., offers kits containing reinforced plastic boat components for home assembly.

The line includes 11 kits, containing parts for five 14-ft. and five 16-ft. runabouts, with starting prices of $299 and $399, respectively, and a 14-ft. sailboat costing $199. These prices are said to be about half those of comparable factory-assembled boats.

All runabouts have three basic RP sections—hull, upper bow, and deck. In addition, RP center-decks and rear deck panels are supplied with certain models. The sailboat kit includes top and bottom RP hull sections. Colors available: white for boat hulls, and a choice of blue, green, yellow, coral, or tangerine for decks.

The plastic parts are produced by hand layup of glass cloth saturated with polyester resin, with gel coat added for surface smoothness and luster. This construction makes the boats immune to salt-water corrosion, extreme heat and cold, marine parasites, rotting, and rusting. As a safety factor, airtight flotation chambers are built into the hulls during the hand layup operation. The assembly operation consists of holding the parts in position with stainless-steel screws, then applying resin-saturated glass mat tape to all seams to make them watertight.



REINFORCED PLASTICS components in kit from which 16-ft. run-about model is assembled include: 1) hull; 2) deck, shown secured to upper bow section; 3) two center deck units; and 4) rear deck panel.

Urethane giant

The mascot at the 58th annual tournament of the American Bowling Congress, which was recently held in Detroit, Mich., was a giant statue carved of low-density polyether-type urethane foam slab stock. Towering 15 ft. above the speakers' stand situated over the tourney's 40 alleys, the ABC symbol weighed 120 lb., exclusive of the non-foam base. Foam for this job was produced by Brede Inc., Minneapolis display firm, using Archer-Daniels-Midland foaming resin. After the statue was carved, the open foam pores were closed by the application of a thin layer of plaster; this in turn was painted gold. Attachment to the base was achieved through a series of embedded rods.

While no cost factors were revealed, it is generally believed that this was probably the lowest-cost method of producing a figure of this size and complexity; and it is likely that this technique will find application at other shows and conventions.

FOAM GIANT stands 15 ft. high, weighs 120 lb. without base. Statue was used as "mascot" for Chicago bowling tournament.

PE replaces wooden tray

Injection-molded high-density polyethylene handling trays for candy, chocolates, and other confections weighs only half as much as traditionally used wooden trays and, especially important in candy making, are very sanitary. The open-grid bottom design permits free air circulation when the trays are stacked. Unlike the wooden tray, the new PE units have no sharp corners for dirt to collect; being non-porous and smooth surfaced, the stickiest residue is easily flushed off the new trays.

W. F. Schraft & Sons Corp., Charlestown, Mass., has a program underway to replace 100,000 wood trays with the new designs. The company is also replacing cardboard layer cards with PE equivalents. This involves ½ million cards.

The new tote boxes, designated Sani-Trays, are produced by W. R. H. Products Co., Rumford, R. I., using Grex material supplied by W. R. Grace & Co., Polymer Chemicals Div.

Polyester-acrylic building "stone"

Formulated for use on either building exteriors or in interior decoration, new fibrous glass-reinforced plastics panels are being produced in molds which faithfully simulate the appearance of natural building stone. The resulting panels, 4 ft. long by 1 ft. wide, and weighing only 4½ lb., can be rapidly applied to almost any existing surface by driving nails through holes in the flanges surrounding each panel.

Terox Corp. of America, Franklin Park, Ill., manufacturer of the new panels, claims that they are being installed as exterior stone veneer for existing homes at the rate of 500 to 700 buildings a month.

The material used in the Terox panels is a compound based on Paraplex P-444, a Rohm & Haas acrylic-modified polyester which was developed specifically for outdoor use. The glass mat is a product of Owens-Corning. According to Terox and Rohm & Haas, this polyester-acrylic resin exhibits unusual resistance to erosion from wind-driven grit, rain, sleet, or snow. It resists degradation from exposure to ultraviolet light and provides unusually good coverage of the panel's reinforcing fibers.

Manufacture of the panels has become a production-line operation. The raw materials—the polyester resin, inorganic pigments (which have been selected for their color permanence), and catalyst—are thoroughly blended and then conveyed to storage tanks near the molding presses. Beside the presses are cutting tables where the glass mat is cut from rolls to the size needed for the presses. After the mats are positioned over the molds, the resin compound is poured over them in precisely measured amounts; when heat and pressure are applied, the resin flows to fill every contour of the mold and to encase every glass fiber of the reinforcement.

In addition to use in homes, offices, and commercial buildings for sidings and interior decoration, it is stated that Terox panels are being widely accepted for beautifying mobile trailer homes, where they provide attractive and durable surfaces. Significantly, the panels do not add prohibitive weight.

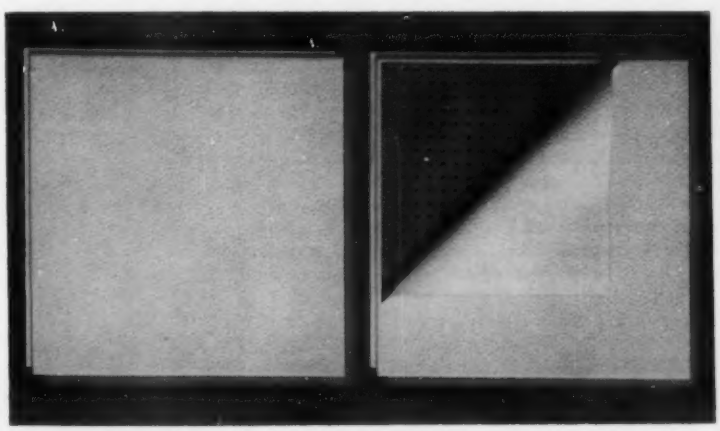
DECORATIVE "STONE" around this interesting fireplace setting is made up of panels of reinforced plastics.

Washable ceiling

The one big plus that a recently introduced vinyl-faced tile brings to the acoustical ceiling field is the fact of washability. This fact now opens the kitchen as a lucrative market for acoustical ceiling tile.

The new product, a development of Allied Chemical's Barrett Div., consists of a perforated fiberboard over which is bonded a thin (2-mil) film of embossed vinyl. The film is supplied by Elm Coated Products, New York, N. Y. In the case of one pattern (Tapestry) the film is calendered and embossed at the same time by Elm. In the case of the two other patterns, the film is calendered by Elm and then post-embossed by Toscany Inc., New York, N. Y. In the case of Premier, the embossing is deep, too deep to be done on the calender. For Sandalwood, the embossing follows a pattern printing operation, also done at Toscany.

The vinyl film acts as a membrane that transmits sound into the perforated wood fiber base, where the holes attenuate it. Average coefficient of noise reduction reported by Allied is 0.65, which indicates the percentage of sound absorbed, and compares favorably with many uncovered acoustical tiles. The tiles can be installed in the fashion of standard fiberboard tiles—cemented directly to an old ceiling or stapled in place on wood strips attached to the ceiling.



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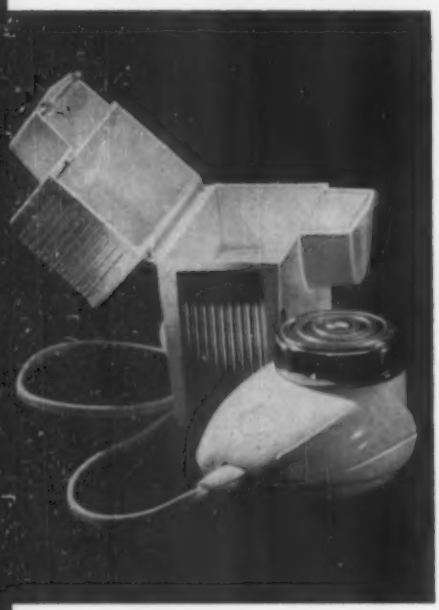
Self-hinge of polypropylene for shaver kit

Economy and easy molding of an intricate, yet highly utilitarian, design are two of the main reasons behind the success of a polypropylene carrying case adopted by Wen Products Inc., Chicago, Ill., for its new rotary electric shaver. According to the manufacturer, this is polypropylene's first commercial application in small, flush-fitting, hinged kits.



The case, including the integral hinge, is molded by Industrial Molded Products Inc., Palatine, Ill., in a single-cavity pin-point-gated mold on a 4-oz. injection machine. Weight of the molded case is 2½ ounces. The molder estimates that specification of polypropylene in this project increased production by 60% over what it might have been with a thermosetting material and thereby saved Wen about 15¢ per unit.

Wen's savings are reflected in both material and labor. Since the self-hinge eliminates the need for hardware and hardware assembly on the case, the units are shipped ready-to-use from the molder directly to Wen's plant. Production line workers at Wen merely attach two strips of decorative metallized Mylar pressure-sensitive tape to the bottom portion of the case, insert the shaver, cord, and cleaning brush, and the unit is ready for carton packing and shipping to retailers across the nation.

In addition to the self hinge—which was tested by Wen through over 1 million flexings without failure—the break and heat resistance of polypropylene, plus the fact that it has a good feel, were among some of the reasons why Wen specified the material for this application.

Toughest problem in the molding of the case, which was solved without undue difficulty, was the shrink factor. Since it is necessary to get a flush fit all the way around when the kit is closed, ways had to be devised to assure this close-tolerance mating. Industrial Molded solved this problem by designing a series of three snap catches, protruding from the lid into the case. These catches fit into indentations molded into the bottom half of the case and produce a snug closure which cannot pop open. Although there is a slight undercut on the snap fittings, there is enough flexibility to polypropylene to make it eject easily from the mold.

More than 25,000 cases have been delivered to Wen for packaging of the rotary-head shaver. Each case measures 4 in. wide, 3⅞ in. long, and 2½ in. deep. The average wall thickness is ⅛ inch.

The material for the carrying case is a general-purpose resin with a melt index of 2.5. Designated Grade 1014, it is supplied by AviSun Corp.

The shaver itself weighs 10 oz. and is encased in a styrene-acrylonitrile housing (Bakelite C-11) molded in a six-cavity family mold. Shaver with case retails for $19.95.

Filled nylon outwears bronze 24:1

Thrust washers made from molybdenum disulphide-filled nylon were used by Wallingford Steel Co., Wallingford, Conn., to solve a maintenance problem on two Sendzimir rolling mills that produce a special foil of stainless steel alloy. The problem: bronze thrust washers, previously used in roll-backing assemblies, failed under compressive load. Up to 50% of the washers had to be replaced every 2 or 3 weeks, depending on the number of shifts the mills had been in operation. Cost of replacing thrust washers averaged $1600 per year. In addition about $1600 was spent annually for new roller bearings to replace bearings damaged by the bronze thrust washers. Bearings were scored and gouged by metal chips imbedded in the bronze washers. In addition, friction between the bronze washers and steel bearings caused heat buildup resulting in heat checks in the bearings. Heat buildup occurred despite the lubrication that was provided by 300 gal. of oil per minute.

Wallingford found its solution in washers machined from tubular bars of Nylatron GS, a composition of molybdenum disulphide and nylon manufactured by The Polymer Corp., Reading, Pa. The thrust washers have now been in service since January 1957 without a failure.

Rigidity and strength of the filled nylon prevents distortion and fracture under compression. Permanent lubrication of the new washers prevents the frictional heat which caused heat checks in bearings run against bronze washers. Nylatron GS's low coefficient of friction against steel assures cool running and prevents heat buildup between the washers and steel bearings. According to the company, no bearings have been damaged by metal chips carried against the bearings by the washers. In use, the resilient washer surface gives slightly in order to accommodate chips and particles, preventing the particles from scoring the bearing or washer surfaces.

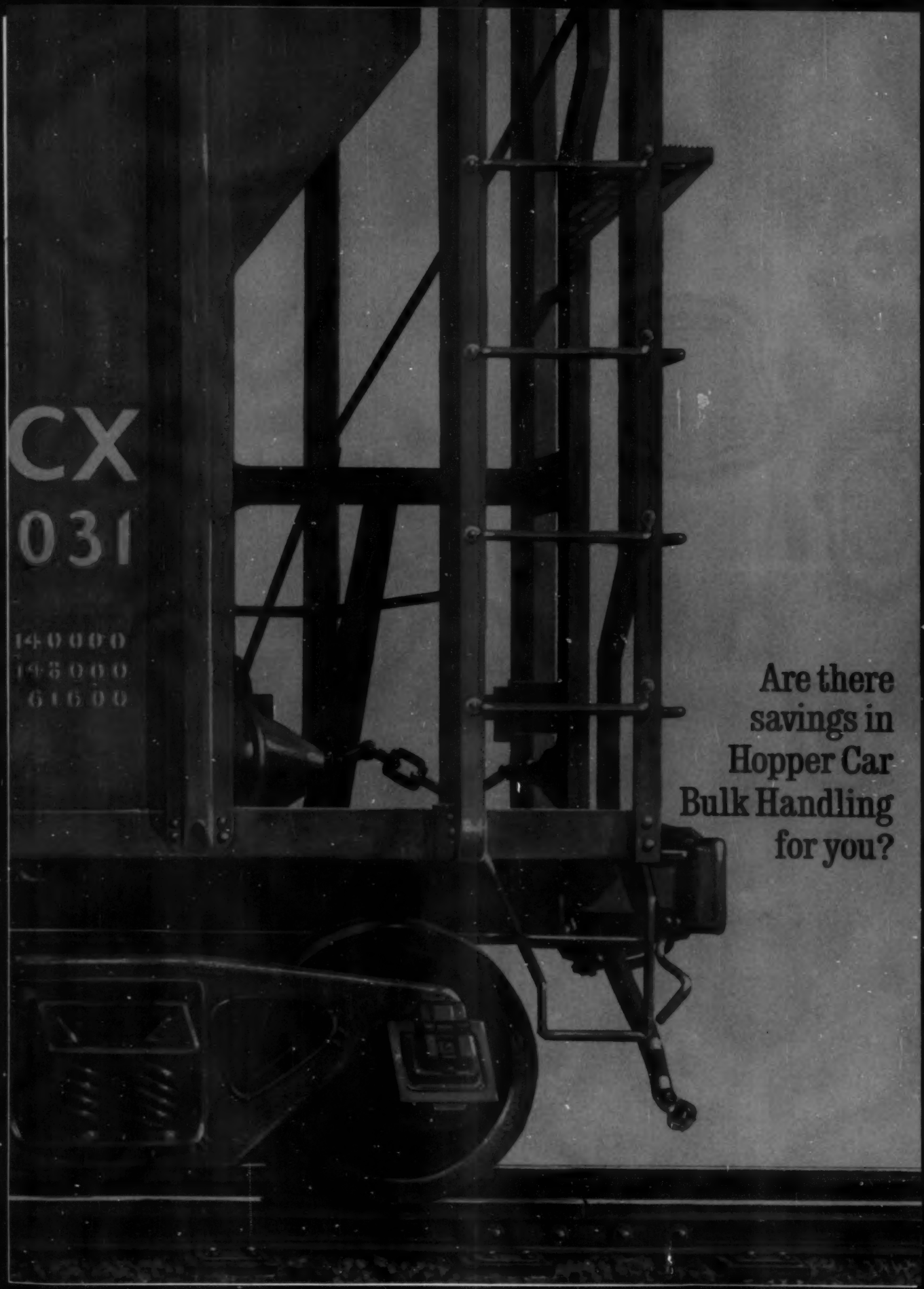
Drum needs no overpack

A 15-gal. carboy, welded together from two halves injection molded of polyethylene copolymer, has been awarded ICC authorization for shipment of regulated chemicals without overpack. This, according to Plastineers Inc., Minneapolis, Minn., is the first all-plastics carboy to achieve this distinction.

Outside dimensions of the carboy are 17¼-in. diam. and 20½-in. height. Empty weight is 17 pounds. Carbon black is added to the molding material to prevent ultra-violet degradation.

The carboys are designed to allow use of a standard polyethylene chemical pump. With the pump installed, both small and large amounts of chemicals may be easily and safely dispensed without danger of spillage. The method by which the two molded halves are joined was described in "Better cores at ½ the price," MPI, March 1959, p. 98.

(More on page 255)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On a tricycle built from polypropylene

ASSEMBLED AND DISASSEMBLED view of polypropylene tricycle. Note extensive use of ribbing on cross bar (right) and handlebar unit.

Several advantages were gained by Chudleigh Mfg. Co., Kingston-on-Thames, Surrey, England, when that company specified molded polypropylene for making a line of children's tricycles:

1. Low cost: The unit is made to retail at 35s ($4.90). This, according to the manufacturer, is half-way between the cheapest and most expensive metal models.

2. Integral color: Since color is molded in, there is no chance of its chipping off and no need to ever repaint the tricycle.

3. Corrosion resistance: No chance for the unit to rust.

4. Strength: By designing the unit with integral ribbing wherever strength was required, the manufacturer produced a product that is able to take all the abuse youngsters are liable to inflict on it. And unlike its metal counterpart, the polypropylene vehicle will not dent.

5. Light weight: Since polypropylene has a specific gravity of 0.91, the tricycle is an extremely lightweight unit, easy for the youngster to use.

There are six polypropylene parts in the vehicle: a large front wheel, two smaller rear wheels, a handle-bar assembly, a cross-bar with integral seat and back stay. The parts are molded in two side-gated molds, running very hot, on a 90-sec. cycle, and assembled to two metal struts by means of split pins. The resin used for manufacturing these English-made tricycles is Propathene—a product of Imperial Chemical Industries Ltd., England.

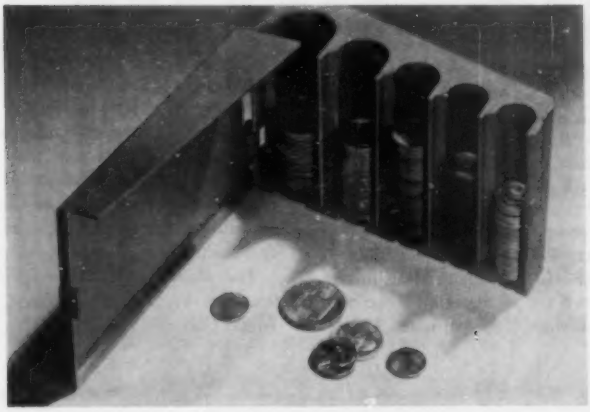
Versatile styrene coin holder

Injection molded of polystyrene to provide high-impact resistance during handling, a compact coin holder, can be used by bank patrons for depositing loose coins, by merchants for checking out cash registers at night, or by newspaper route boys.

The holder can also serve as a portable cash register at bake sales, ball games, and other functions. Another application might be as a promotion piece, in which the flat cover of the holder is imprinted with company or bank name.

The multiple-use product has compartments for pennies, nickels, dimes, quarters, and half dollars. Molded-in decimal calibrations make it easy to determine the total amount of money in the holder. The flat cover, joined to the money compartment by an integrally-molded hinge, protects the coins being transported.

The coin holder is marketed by Estrem Distribution Inc., Slayton, Minn., and is available in blue, yellow, green, or pink color. It weighs 4 oz., measures 6½ by 3½ by 1½ in., and costs approximately $1 per unit. Molder is Rainbow Plastics Co., Minneapolis, Minn., using Koppers Dylene high-impact polystyrene.



Decorative laminate with U/L label

Greater use of decorative laminates in public buildings and vehicles is expected to result from the introduction of a fire-resistant high-pressure laminate, according to the manufacturer, Westinghouse Electric Corp. A successor to material developed for shipboard use, the new laminate, with a base that includes asbestos, has met code requirements of the Underwriters' Laboratories and is in production at Westinghouse's Micarta plant in Hampton, S. C. It is said to be the only high-pressure decorative laminate with the U/L label.

Among the claims made for the 0.050-in. material are the following: 1) It is suited for hard-use applications where surface durability and fire resistance are important, such as public buildings, trains, buses, airplanes, and ships; 2) It meets or exceeds NEMA standards for resistance to fade, wear, moisture, stain, hot water, elevated temperatures, and dimensional stability; 3) It will not crack, craze, or blister in normal applications.

The laminate is available in all standard patterns, colors, and wood grains, in all standard sheet sizes.

(More on page 256)

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combination slip and anti-block additive for films, sheeting and tubing. VYN-EZE produces greater efficiency and speed in the winding, handling and converting of Vinyls – gives you a new standard for improved clarity along with anti-tacking characteristics. FDA APPROVED.

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Tricky corrosion problem licked

A new vinyl-urethane coating system has been evaluated and accepted as the standard protective finish for the Grumman Ag-Cat, a plane specifically designed for aerial application of agricultural chemicals.

Produced by Carroll Products Inc., Farmingdale, N. Y., the new coating effectively protects the plane against a large variety of corrosive dusts and liquid chemicals under conditions of extreme temperature variations (*e.g.*, parts of the plane near the engine are exposed to very high temperatures).

The new coating is supplied as a two-part solvent system. One part contains polyisocyanate, supplied by Mobay Chemical; the other a modified vinyl chloride-acetate copolymer, supplied by Union Carbide Plastics Co. under the designation VAGH.

The hydroxyl groups introduced into the vinyl during synthesis provide reactive points for cross-linking the isocyanate molecules, thereby converting the normally thermoplastic vinyl resin to a thermosetting material. The chemical- and weather-resistant properties of the vinyl are retained and improved because the crosslinked structure reduces the solubility of the resin and increases its heat stability.

Pot life of the mixed coating system is about 8 hours. The coating can be applied by conventional brush, spray, dip, or roller coat techniques. They cure completely by air-drying or by baking for 10 to 15 min. at a temperature not exceeding 250° F.

In addition to this specific application, the coatings—which can be used with metal or wood substrates—may also find use in chemical process equipment, tanker linings, boat decks, and laboratory furniture.

Epoxy saves time

An electrician can now install a junction box in 2 min. on tile or masonry walls or ceiling surfaces, using a new epoxy adhesive. The same job takes about 15 min. by the conventional expansion bolt or plug method. Coated with the new adhesive, a junction box will remain on the wall, without sliding, after it has been held in place for only about 5 seconds.

The new material, called Permacel Junction Box Mount, has been put on the market by Permacel, a division of Johnson & Johnson. It is packed in a divided container. One side holds the epoxy resin and the other side the hardener. Before use, the divider is removed and the material is mixed.

About 8 oz. of material is enclosed in the divided cup package. This is sufficient, according to Permacel, to mount 8 to 10 4- by 4-in. junction boxes. Eight to 10 boxes, the company added, can be placed in less than 15 min., about as long as for a single installation by drilling and bolting.

The epoxy resin, after it has been mixed, remains usable for about 30 minutes. Curing time, at 70°, is 3 to 4 hours. At lesser temperatures, more time should be allowed for curing.

Foam sailboat

Molded of expandable polystyrene, 12-ft. sailboat weighs only 45 lb., yet can support over 600 lb. in the water. The sails are made of polyethylene film. Retail price of the craft is $99.50, f.o.b. factory. Designated the Blue Dolphin, the boat is made by McGowen Mfg. Co., Elizabeth, N. J., using expandable styrene beads and PE film supplied by the Plastics Div., Koppers Co. Inc.

PE expansion sleeving for steam pipes

Extruded polyethylene sleeving is simplifying the job of providing uniform expansion gaps for steam tubes passing through the refractory walls of superheaters—and is effecting substantial reduction in labor costs.

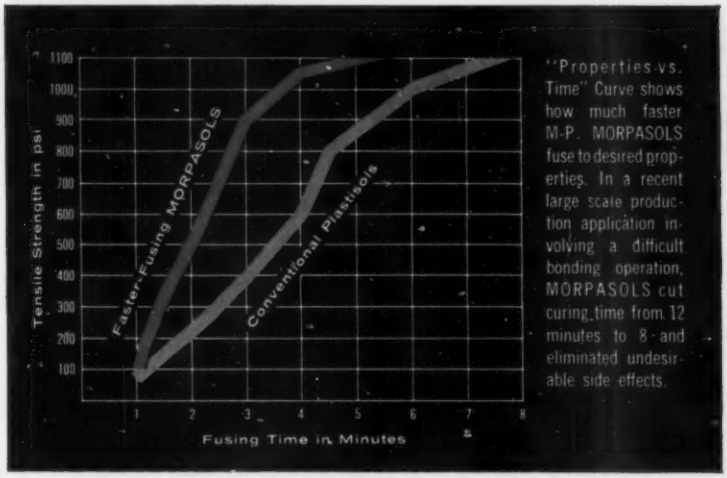
Superheater tubes in the steam generator pass through the refractory wall in four places. When the boiler is built, the tubes are, of course, cold. If no provision were made for gap, the tubes would expand directly against the wall when the boiler is started, thereby causing the refractory to crack.

Formerly, the tubes were wrapped with paraffin-dipped paper or covered with a brushed-on coating. Since from 700 to 1000 tube sections must be covered, these early methods were extremely time-consuming. By going to extruded PE, one manufacturer reports savings of 80 hr. of assembly time, the equivalent of $300 per boiler.

The polyethylene extrusions, made to a wall-thickness tolerance of ±0.005 in., are split along one side and slipped over the boiler tubes before the refractory is cast in place. At about 250° F., the polyethylene sleeve will melt, leaving a gap for the boiler tube to expand in. Since, in addition to cutting labor costs, the polyethylene parts also provide for a more uniform gap than could be obtained by wrapping or painting, each joint will be same as the next, permitting tighter tolerances in boiler construction.

The sleeves are extruded to specifications by Anchor Plastics, Long Island City, N. Y.—**End**

NEW *From Morningstar-Paisley*



"Properties vs. Time" Curve shows how much faster M-P MORPASOLS fuse to desired properties. In a recent large scale production application involving a difficult bonding operation, MORPASOLS cut curing time from 12 minutes to 8 and eliminated undesirable side effects.

■ MORPASOLS, new faster-fusing vinyl plastisols developed by Morningstar-Paisley, can revolutionize your process, save you time and money. ■ MORPASOLS give you uniform cure in less time with lower heat. The accompanying curves show how MORPASOLS and conventional vinyl dispersions compare in time and heat requirements. ■ Using MORPASOLS, "hot spot-cold spot" oven conditions can be overcome and more uniform curing obtained.

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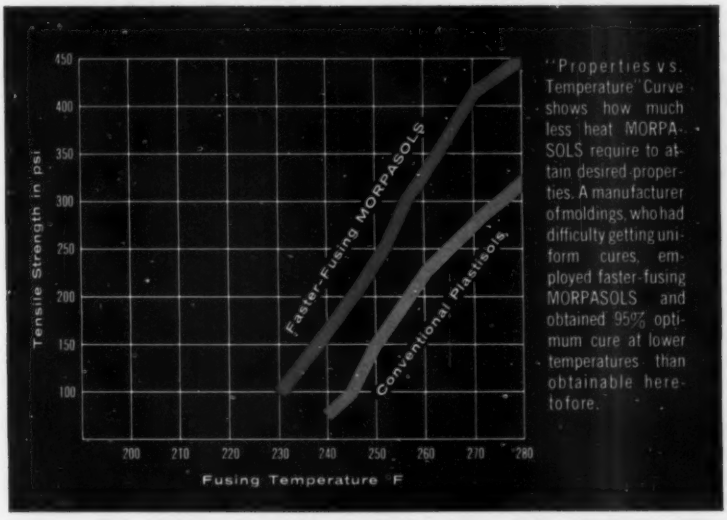

"Properties vs. Temperature" Curve shows how much less heat MORPASOLS require to attain desired properties. A manufacturer of moldings, who had difficulty getting uniform cures, employed faster-fusing MORPASOLS and obtained 95% optimum cure at lower temperatures than obtainable heretofore.

Plastisol applications, previously not feasible because of the high fusing temperatures required, can now be considered. You can improve physical characteristics, cut rejects and boost your production rate. ■ Manufacturers of automotive filters, sewer-pipe gaskets, coated-wire products, vinyl to fabric laminates and others are using M-P MORPASOLS with amazing results. ■ Tell us about your specific application and problem. Our field service men will do the rest.

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LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Source Book of the New Plastics—Volume II," by Herbert R. Simonds.

Published in 1961 by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 310 pages. Price: $8.95

Essentially a status report on the progress made in the development of new materials, this book is an updated version of its predecessor, Volume I. Included are reports on 69 companies and new products being offered by these companies. Also covered in highlight fashion are advances in polymer technology, government research, and market information. Major value of the book lies in having all the information summarized in one place. The book is of general interest to anyone wanting to be kept up-to-date on material developments in the plastics industry and on who's doing what.—*G.R.S.*

"Progress in Plastics," *Edited by Phillip Morgan*

Published in 1960 by The Macmillan Co., 60 Fifth Ave., New York, N. Y. 216 pages. Price: $12.00

This book is a bound edition of technical papers and discussions presented at the International Plastics Exhibition in Olympia on June 17-27, 1959, which was jointly sponsored by *British Plastics* magazine and the British Plastics Federation. Topics of the papers include: polypropylene and its molding characteristics, new epoxy resin systems, crosslinking of thermoplastics after fabrication, block and graft copolymers, progress of plastics in various countries, foamed plastics, and extrusion. Several of the papers contain valuable data on the processing and physical properties of the various materials discussed. The book is good reading for the plastics engineer who wants to broaden his perspective.—*G.R.S.*

Polypropylene. Melt-flow characteristics and other data for six grades of Pro-fax polypropylene. Bulletin 510. 2 pages. *Hercules Powder Co., Cellulose Products Dept., Wilmington, Del.*

RP-fibrous glass. Bulletin describes a range of products being molded with the company's fibrous glass-reinforced plastics and wood chip materials. 8 pages. *Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.*

Injection molding equipment. Specifications, features, accessories, prices, etc., for a line of grinders, drum tumblers, mold temperature recirculators, mold chillers and releases, wipe-on type lubricants, gate cutters, platen hole savers, mold clamps and sets, drying ovens, cylinder plungers, heating cylinders, etc. This is said to be the only completely-priced industrial handbook available to the injection molding industry. 1961 Edition. Supersedes all of the previous issues of this catalog. 72 pages. *Injection Molders Supply Co. Inc., 17601 S. Miles Rd., Cleveland 28, Ohio.*

Small acetal moldings. "GRC Injection Molded Tiny Delrin Parts" describes the facilities and services available for molding pieces with acetal resin. Includes mechanical, chemical, and physical properties of the material. 8 pages. *Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.*

Pigments. General considerations, orientation, formulations, application procedures, etc., for Mearlite nonlead synthetic pearl, Murano synthetic pearl in colors, Mearlmaid natural pearl essence, and Nacromer synthetic pearl pigment. 8 pages. *The Mearl Corp., 41 E. 42nd St., New York 17, N. Y.*

Production facilities. Brochure describes the engineering and product design facilities; tooling, fabrication, and testing equipment available for molding rigid PVC, Teflon, Kel-F, polycarbonate, Delrin, Penton, ABS, polypropylene, nylon, and linear polyethylene. 10 pages. *Dynatech Plastics Inc., 1225 E. Wakeham Ave., Santa Ana, Calif.*

Polyethylene. Physical and electrical properties, chemical resistance, environmental stress-cracking, resistance to heat and environment, thermal embrittlement resistance, uses, and other technical data for Ameripol PE, a new Ziegler-type ethylene plastic polymer. 12 pages. *Goodrich-Gulf Chemicals Inc., 1717 E. 9th St., Cleveland 14, Ohio.*

Acetylene derivatives. "High-Pressure Acetylene Derivatives" gives properties and uses, chemical structures, physical forms, etc., for these products, including PVP, PVP/VA copolymers, PVP-iodine, vinylpyrrolidone, methylpyrrolidone, 2-pyrrolidone, butyrolactone, 1,4 butanediol, butenediol, butynediol, and propargyl alcohol and halides. 6 pages. *Acetylene Chemicals Department, Antara Chemicals, 435 Hudson St., New York 14, N. Y.*

Sandwich Panel Design Criteria. Proceedings of the B.R.I. Fall Conference, held in Nov. 1959. Includes such topics as "The NAHB Research House in South Bend, Ind.;" "Air Seal Panel Buildings;" "Bonded Joint Panel Buildings;" and "Light-Transmitting Sandwich Panels." 210 pages. Price: $8.00. *Building Research Institute, National Academy of Sciences, National Research Council, 2101 Constitution Ave., Washington 25, D. C.*

Butyrate signs. "A Guide to the Use of Tenite Butyrate for Colorful, Durable Outdoor Signs" discusses historical background; breadth of applications; design considerations; vacuum air-pressure and mechanical forming; fabrication procedures; decoration; illumination of plastic signs; etc. 42 pages. *Eastman Chemical Products Inc., Kingsport, Tenn.*

Plexiglas in Architecture, illustrated with photographs of typical applications, discusses the use of methacrylate sheet in lighting, daylighting, facades, signs, art treatments, etc. Describes properties and characteristics; lists types, sizes, thicknesses, and colors. A.I.A. File 24. 20 pages. *Rohm & Haas Co., 222 W. Washington Sq., Philadelphia 5, Pa.*

Fasteners. Specifications, thread sizes, and uses for taper-thread and push-insert fasteners for installing in plastics parts after molding. 4 pages. *Fastener Products Inc., 239 Danbury Rd., Wilton, Conn.*

Nylon. Available shapes, sizes, properties, etc., for nylon rod, plate, strip, tubing, and molding shapes. 8 pages. *Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.*

Knife cutter. Specifications, uses, and features for a rotary knife cutter, designed to granulate polyethylene and polypropylene film (0.0015 to ⅛ in. thick) in widths up to 48 inches. Specification Sheet 227. 2 pages. *Sprout, Waldron & Co. Inc., 130 Logan St., Muncy, Pa.*

Mixers. Specifications, features, and models available for a line of light, medium, and heavy- **(To page 260)**

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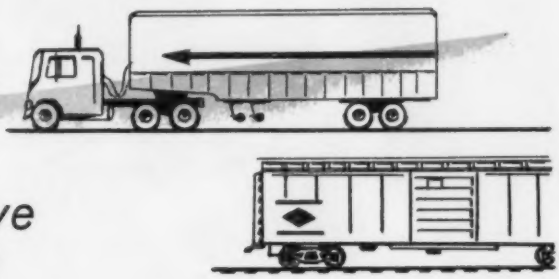

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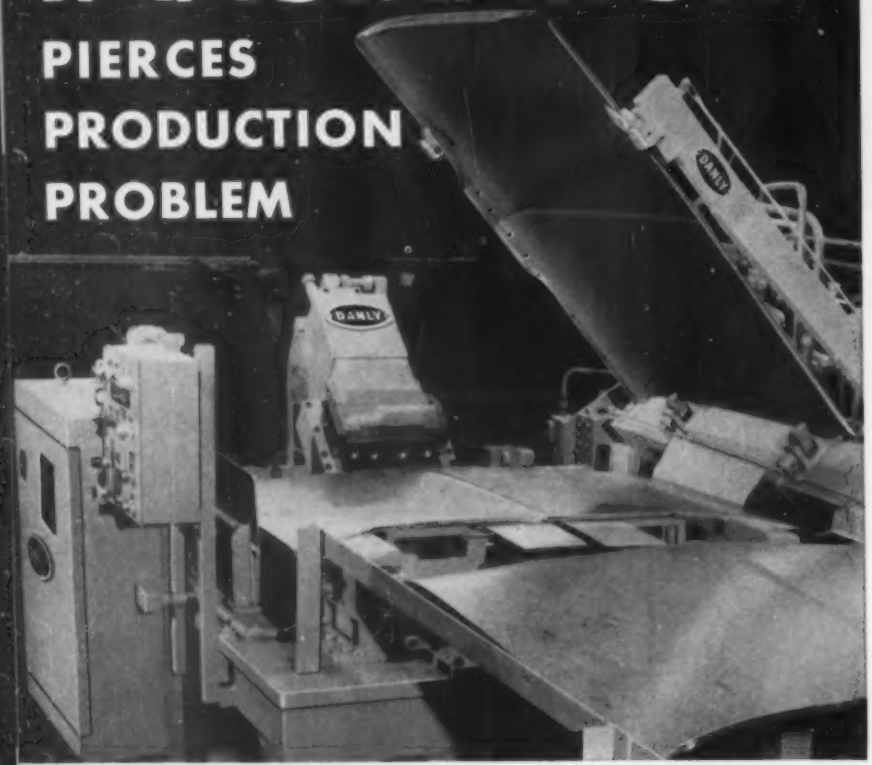

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duty mixers. Tilting types range from 5 to 200 gal.; nontilting types range from 20 to 1000 gallons. Bulletin 1260. 8 pages. *The J. H. Day Co., 4932 Beech St., Cincinnati 12, Ohio.*

Tributyltin oxide. Chemical and physical properties, formulation, applications, toxicology, etc. for TBTO bis (tributyltin) oxide, which is used, among other things, to control fungi, bacteria, algae, and marine organisms on plastics surfaces, notably PVC. 4 pages. *Metal & Thermit Corp., 100 Park Ave., New York 17, N. Y.*

Weigh-feeder. Specifications, features, and uses for a compact-model weigh-feeder for 10 oz. and under small-capacity injection molding machines. Bulletin 3485. 4 pages. *The Exact Weight Scale Co., 541 E. Town St., Columbus 15, Ohio.*

Urethane foams. "The Profitable Present and the Fabulous Future of Urethane Foams" traces the development of foams; outlines property and performance data; includes suggested uses. 24 pages. *Mobay Chemical Co., Penn Lincoln Parkway West, Pittsburgh 5, Pa.*

PVC resins. Properties, versatility, processing, test methods, etc., for a line of Vygen polyvinyl chloride resins. Includes general information on plasticizers, stabilizers, colorants, fillers, and lubricants. 58 pages. *The General Tire & Rubber Co., Chemical Div., Akron, Ohio.*

Adjustable speed drives. Features, specifications, uses, mounting positions, rating tables, accessories, etc., for the ¼- and 25-hp. line of Polydyne adjustable speed drives for the plastics and other industries. Bulletin GEA-6806. 16 pages. *General Electric Co., Schenectady 5, N. Y.*

Polyethylene. Properties, suggested applications, etc., for a line of Marlex resins: high-density PE, ethylene copolymers, and tailored resins; medium-density PE and tailored resins; and low-density PE and tailored resins. Data File 4. *Phillips Chemical Co., Bartlesville, Okla.*

ABS resin. "Kralastic for Product Engineering and Design" describes the properties, variety of applications, types available, etc., for a line of acrylonitrile-butadiene-styrene resins. 28 pages. *United States Rubber Co., Naugatuck Chemical Division, Naugatuck, Conn.*

Production facilities. "Engineered Plastic Products of Foamed and Reinforced Plastics with **(To page 264)**

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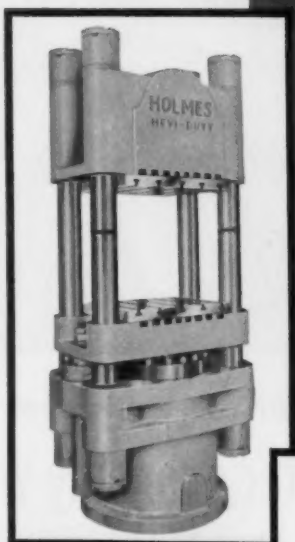

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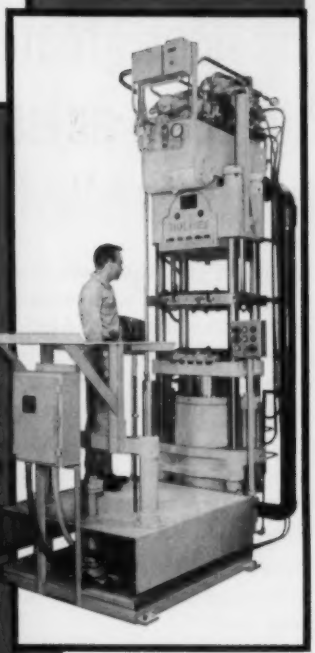

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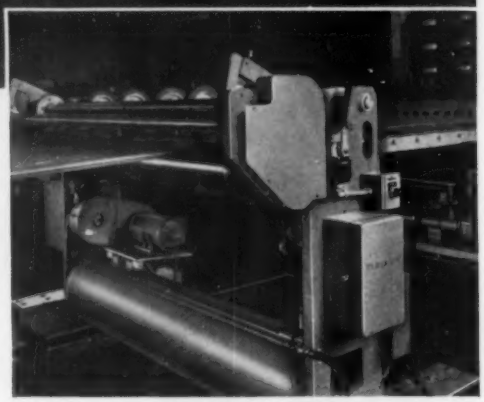

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Controlled Properties" describes production facilities and outlines typical applications. Bulletin 611. 4 pages. *Poly-Structures Inc., 41 Montvale Ave., Stoneham, Mass.*

Hydraulic presses. Specifications, models available, capacities, uses, etc., for a line of hydraulic machinery and equipment for processing plastics, rubber, and other materials. Includes data on calenders, mills, mixers, presses, etc. 34 pages. *Stewart Bolling & Co. Inc., 3190 E. 65th St., Cleveland 27, Ohio.*

Vacuum former and die cutting press. Specifications and features for a drape and vacuum forming machine. Bulletin 10. 4 pages. Similar data for a pneumatic die cutting and heat sealing press. Bulletin 9. 1 page. *Comet Industries Inc., Franklin Park, Ill.*

New house organ. *Sarcoscope,* which has a circulation of about 50,000, deals with all aspects of steam traps, temperature controls, industrial air-venting, and heating specialties. *Sarco Co. Inc., 635 Madison Ave., New York 22, N. Y.*

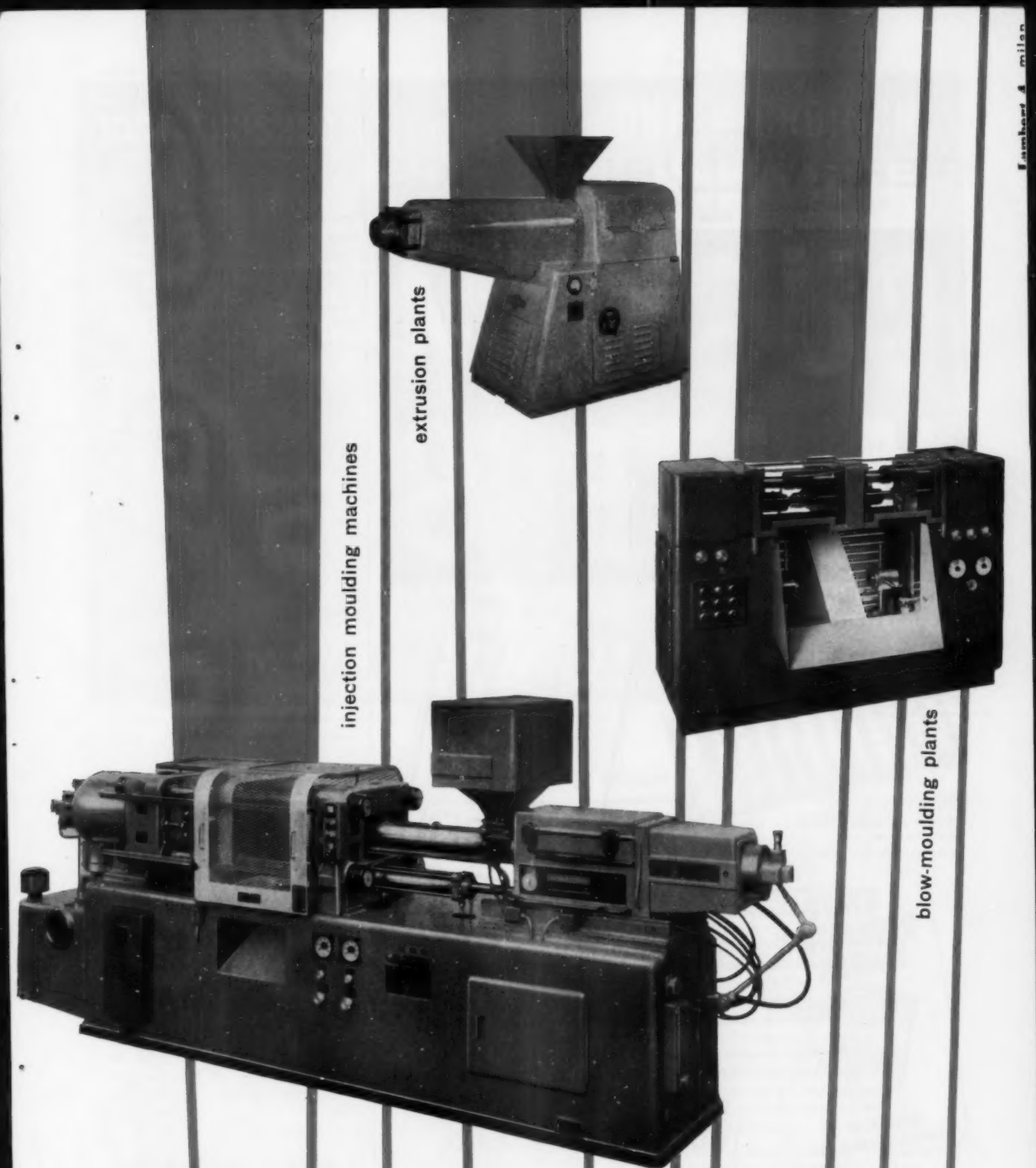
Polyester glass-mat laminates. Properties, grades, and uses for 10 grades of Micarta glass-mat laminates and three grades of fibrous glass molding compounds. Bulletin 8216. 8 pages. *Westinghouse Electric Corp., Micarta Div., Hampton, S. C.*

Plastic Die Steels shows mold makers how to match die steels for their particular jobs. Tables list mold properties and simplified heat treating instructions. 12 pages. 6 Data Sheets. *Vanadium-Alloys Steel Co., Latrobe, Pa.*

The Story of Plastic Pipe is an up-to-date review of plastic pipe technology, applications, codes, etc., pointing up the fast-growing acceptance of this product. 466-item bibliography. 26 pages. *The Society of the Plastics Industry Inc., 250 Park Ave., New York 17, N. Y.*

Blow molding. "Blow Molding: Plastic Shapes from Design to Finished Product" poses some questions and answers about this technique, and outlines the production facilities available at this plant. 4 pages. "Blow Molding Brings 50% Cost Reduction" is a case history of how costs were cut on a blow molded PE blinker light component. 4 pages. *Dewitt Plastics, Auburn, N. Y.*

Polyester resins. "Laminac Polyester Resins for Spray-Up Applications" describes spray-up **(To page 266)**



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techniques, safety procedures, coloring, and measuring. 5 pages. "Laminac Polyester Resins Selector" lists characteristics, fabricating procedures, and end uses of 24 standard formulations. 12 pages. *American Cyanamid Co., Wallingford, Conn.*

Prepregs. Case studies on how and why manufacturers are using prepregs, and tables on the resin-reinforcement combinations available, their characteristics, and applications. Prepared by 13 members of the Prepreg Div. of S.P.I. 8 pages. *The Society of the Plastics Industry Inc., 250 Park Ave., New York 17, N. Y.*

Anti-static agents. Features, uses, prices, etc., for a line of anti-static compounds for plastics and other materials. Bulletin 6. 4 pages. *Merix Chemical Co., 2234 E. 75th St., Chicago 49, Ill.*

Reinforced plastics. *RPF News* is the name of a new, bi-monthly newsletter dealing with reinforced plastics fabricating. To be placed on the mailing list, write: *Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.*

Motors. Speed and hp. tables, modifications, prices, accessories, dimensions, and other engineering information for Reeves Vari-Speed Moto-drives, which are used in the plastics and other industries. Catalog G-100. 90 pages. *Reeves Pulley Co., Div. of Reliance Electric & Engineering Co., Columbus, Ind.*

Epoxy resins. Properties and applications for Araldite epoxy resins, used for coatings, adhesives, laminating, tooling, repairing, etc. 8 pages. *CIBA Products Corp., Fair Lawn, N. J.*

Chlorinated polyether. "Penton—an Engineering Polymer" describes the properties, molding and forming data, applications, etc., for this material. 26 pages. "Penton Buyers Guide" lists the manufacturers of chemical processing equipment made with Penton. 22 pages. "The ABC's of Penton for Corrosion Resistance" describes typical uses for Penton. 6 pages. *Hercules Powder Co. Inc., 910 Market St., Wilmington 99, Del.*

PE crosslinking agents. Specifications, properties, thermal decomposition data, applications, etc., for Luperco 130-XL, a substituted diperoxide catalyst for the crosslinking of linear polyethylene. It is said to be effective at temperatures 30 to 40° F. higher than comparable agents. Data Sheet 7.302. 7 pages. *Lucidol Div., Wallace & Tiernan Inc., 1740 Military Rd., Buffalo 5, N. Y.*—**End**

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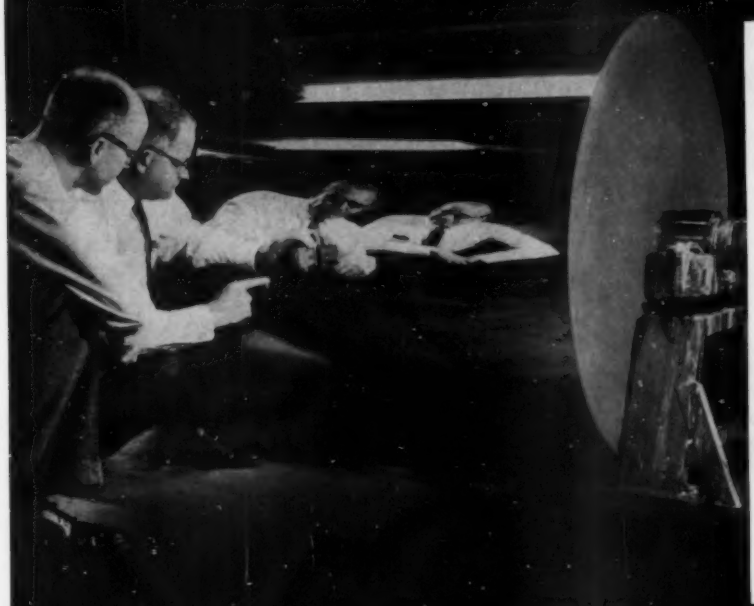

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Plastics patents

(*From page 72*)

Fluorine-containing polymers. E. S. Lo (to Minnesota Mining). 2,970,988.

U.S. Pats., Feb. 14, 1961

Plastic foam packaging. C. D. Snelling (to Standard Plastics). 2,971,640.

Polymeric composition. H. P. Dupuy, L. A. Goldblatt, and F. C. Magne (to U. S.). 2,971,855.

Polypropylene sheet. E. di Giulio and P. Parrini (to Montecatini). 2,971,858.

Pressure-sensitive tape. H. V. Kindseth and T. B. Ludlow (to Bemis). 2,971,863.

Aminated organosilanes. J. L. Speier (to Dow Corning). 2,971,864.

Plastic bags. L. E. Canno (to Equitable Paper Bag). 2,971,874.

Reinforcing Teflon. F. R. Chaffin (to W. S. Chamban). 2,971,908.

Maleic anhydride-diisobutylene copolymer. G. L. Brown and R. W. Percival (to Rohm & Haas). 2,971,934.

Vinyl sulfonic acid copolymer. V. D. Floria (to Dow). 2,971,935.

Polyether resins. M. Dubien and P. Vacelet (to American Marietta). 2,971,936.

Acrylonitrile-N-vinylpyrrolidone copolymer. G. E. Hame and A. B. Craig (to Chemstrand). 2,971,937.

Polyisobutylene resin. L. R. McNall, W. J. G. McCulloch, and C. E. Farnsworth (to Esso). 2,971,938.

Vinylidene-maleic copolymer. M. Baer (to Monsanto). 2,971,939.

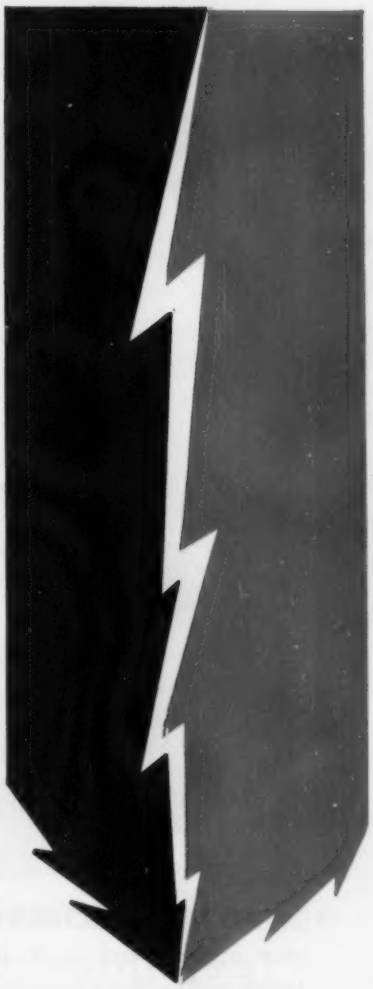
Stabilized polypropylene. C. H. Fuchsman, A. M. Nicholson, and S. B. Elliott (to Ferro). 2,971,940-1.

Maleimide polymers. Sui-Wu Chow and J. M. Whelan Jr. (to Union Carbide). 2,971,944.

Antistatic molding resins. V. D. Floria and F. E. Towsley (to Dow). 2,971,947.

Vinyl chloride copolymers. G. Messwarb, W. Denk, and H. Scherer (to Lucius & Bruning). 2,971,948.

Isotactic poly(alpha-olefins). Natta, Pasquon, Giachetti, and Scalari (to Montecatini). 2,971,950.—**End**



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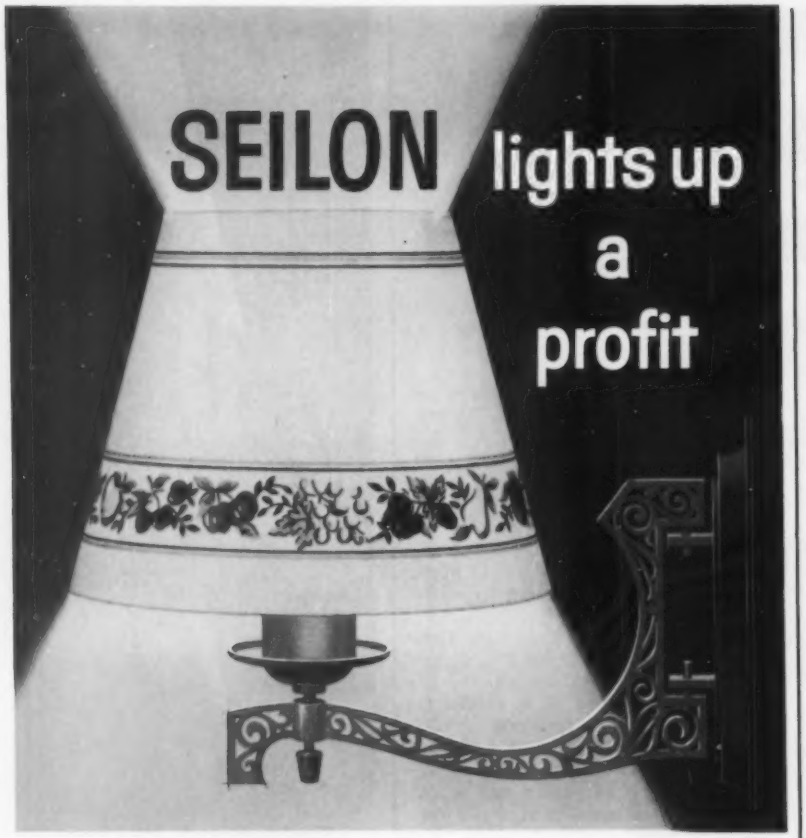

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Wide world

(*From pp. 128-130*)

pumps—made of this plastic. All parts commercially available. Also coatings and linings for metal pipe to take high temperatures.

Polycarbonates. Parallel trends in application in Europe and in the U. S. will be observed. The attack on metal markets and on plastics of lesser qualities will be obvious. The first relatively large molded pieces will be on display, indicative of the impact the material is expected to make in engineering-type applications.

Polyethylenes. The trend is towards specialty resins for specific purposes such as film, pipe, sheet for forming, cable and paper coatings, injection and blow molding. A wider variety of densities will be available through copolymers and blends. New very-high-density materials for industrial use may be shown. The first polyethylene latex for paper and cotton sizing may be on display.

Polypropylenes. Special attention is being paid to the improvement of cold-temperature resistance, to the production of special types for film and fiber, to alloys and copolymers for industrial use. One feature of the show will be the number of suppliers that will be exhibiting products made from this resin.

Styrene plastics. Again, watch for new copolymers and alloys, aside from the new ABS materials. New uses for styrene foams, new methods of making them, and new interest in oriented styrene sheets are indicated. The material's impressive potential for the packaging field (in film, molded, formed, and foamed form) will be very much in evidence.

The vinyls. Watch the new rigid vinyls, the copolymers, the laminates, the foams (rigid and soft), and the plastisols. New ideas in rigids—including a thin, transparent sheet for thermoforming, especially for packaging, will be seen. Keep your eyes open, too, for the "other" vinyls—the vinyl alcohols and vinyl acetates that are making a big push in the packaging and construction fields.

Urethanes. Already established in automobiles, furniture, and refrigerators, the urethane foams,

Amaplast Colorants provide these beneficial advantages!

Amaplast colors were developed to provide higher industry standards of performance for all rigid plastics. They enable designers, molders, blenders and manufacturers to achieve exact shades and requirements specified by their customers.

These select dyes and pigments are 100% pure dye, possessing inherent qualities with manifold benefits. Amaplasts have high bulking values, excellent dispersion properties, high heat stability and superior light fastness. These factors enable colorists to attain full color strength at higher speeds of operation without streaking or specking. In addition, extremely high tinctorial strength means faster production and greater economy. A little goes a long way—for only small quantities are required to attain full bright shades in transparencies and tints that will not crock.

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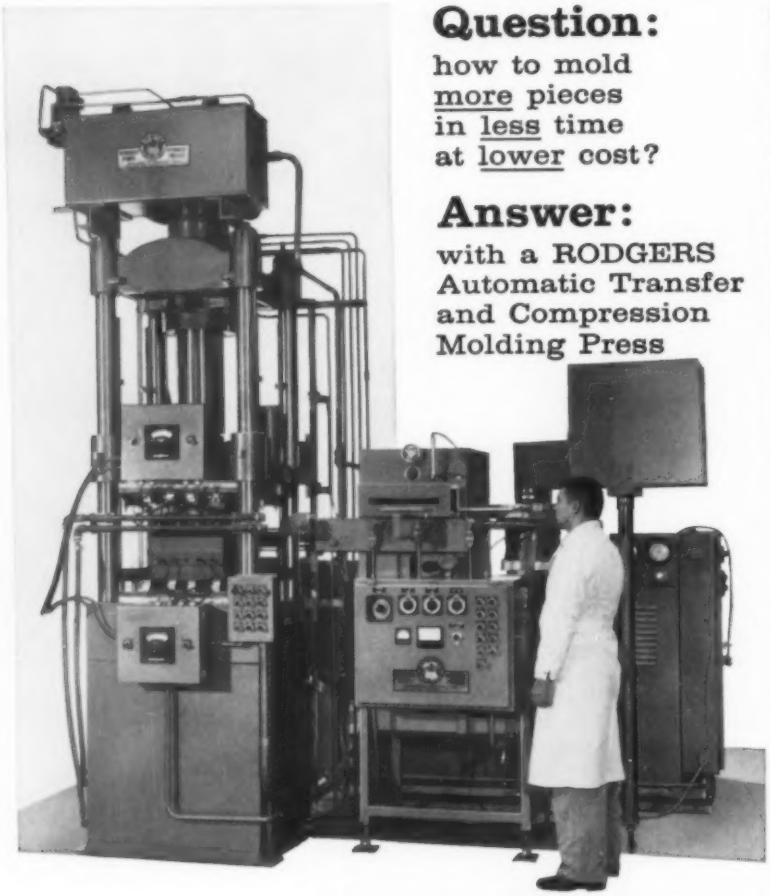

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in less time
at lower cost?

Answer:
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particularly the rigids, are moving into the building field. Urethane coatings will get some attention. New versatility to the urethanes is provided by the fact that there are now elastomers, both thermoplastic and thermosetting, that can be processed on plastics processing equipment, and whose economics may expand the urethane elastomer field manyfold.

The thermosets

As for the thermoset plastics; here is the picture as MODERN PLASTICS sees it:

Diallyl phthalates. New ideas will be offered in vertical decorative laminate surfacing, in premix electronic moldings. The use of thin, printed DAP papers with low-cost base sheets for interior walls of buildings is expected to increase in the near future.

Epoxies. In the building field, in electronics, in coatings, in adhesives, in aircraft and missile parts the epoxies will be shown in variety. These plastics have enormous potential because of their ability to alloy with lower-cost materials.

Polyesters. More attention will be paid to flame-resistance, to the prepregs, the reinforced compounds, to combinations for spray-up, and to materials for larger-size moldings than have been made before now. Again various alloys are being evaluated.

Phenolics. The old work-horses of the thermoset industry have taken on fantastic new jobs and new glamor because of their use in heat-sink and ablative plastics for outer-space programs. The combinations involved are leading to a new range of reinforced thermosets for industrial and electrical use. Phenolics may now be decorated in the mold, as can the melamines and ureas, to obtain a whole range of decorative effects. With the profit squeeze continuing to plague the industry, expect emphasis here on fully-automatic molding.

Melamines. Watch the trend towards industrial use of in-mold foil decoration, now so successful in dinnerware. Deep draws in compound curves are now possible and practical. Watch also for more reinforced and filled melamines for industrial purposes.

Ureas. Emphasis will be on faster

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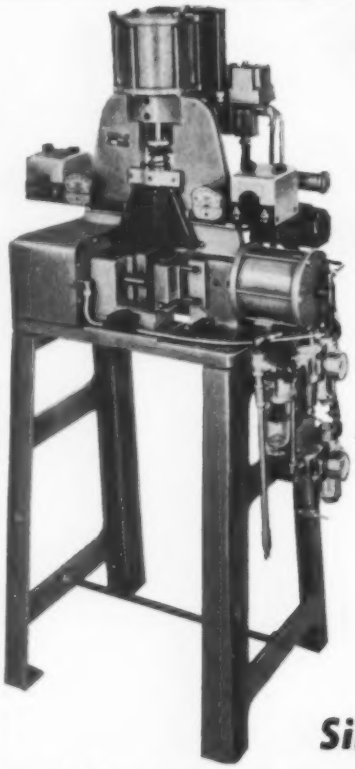

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Check the "Big Giant" features

Automatic Cycle Speed—50 to 500 p/h
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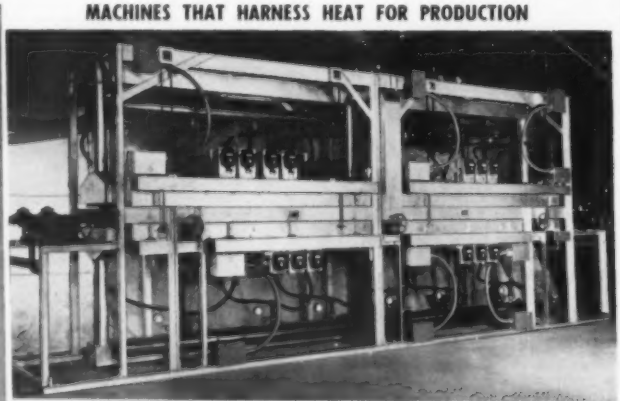

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cure and on flame-resistance. The ureas can now be decorated by the same methods as are being used for the melamines.

Processing: methods and equipment

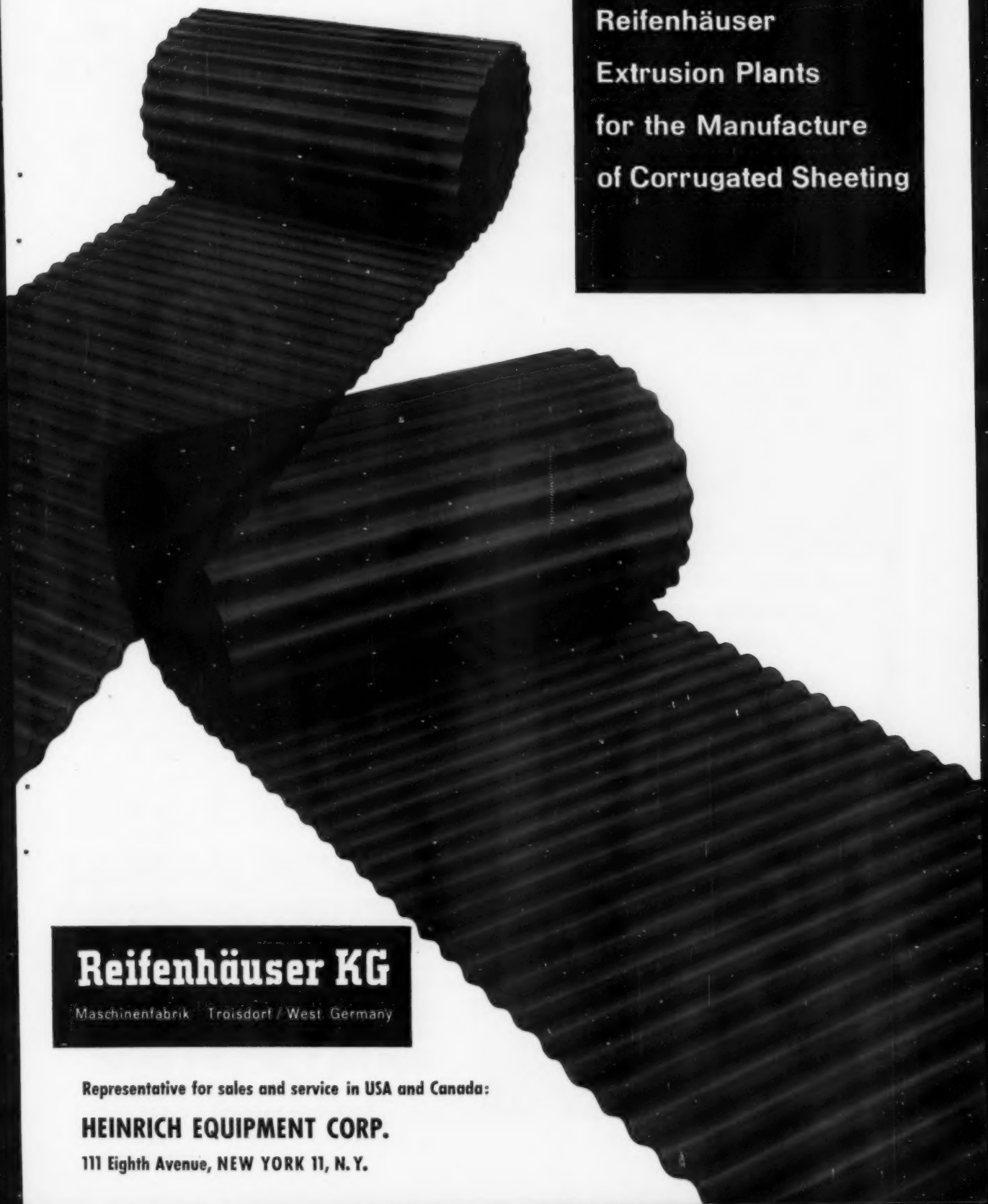
In processing methods, in machinery and equipment, the developments of the past two years have been notable. The changing approach to cross-licensing and distribution of equipment based on specific methods will be observed at the June shows. It can be expected that more European processing equipment will be licensed to be manufactured, sold, and served in the United States, and vice-versa. There will be increasing evidence of single-purpose machines as well as many machines more versatile than those seen to date. Quite a few machinery and equipment makers have kept under wraps the surprises they will spring at the shows. Nevertheless, to close observers of the plastics industry, the trends are obvious in Europe and the U. S.

Extrusion. In film production, in pipe, in sheet the trend is toward the totally-engineered plant for single-purpose high production and for increased accuracy of production. From Europe will be announced two new pieces of equipment for the above-mentioned quantity production of rigid vinyl sheet, flat and corrugated. One or more American manufacturers will probably announce especially balanced combinations of extrusion and blow-molding equipment. And from several directions will come more versatile extruders, with interchangeable heaters and quick purging to meet the needs of the smaller processors who want to make different profiles from different materials.

Injection. While the ram preplasticator holds its reputation for efficiency in continuous long-run operation, the screw preplasticator will be big news at this show. For some of the newer materials such as rigid vinyl, being so dense, screw preplastication is a logical answer. We can also expect more fully automatic small injection machines for the packaging field.

Compression and transfer. Here again the trend is toward full automation with new powder preheaters. Special machines **(To page 277)**

BOPP



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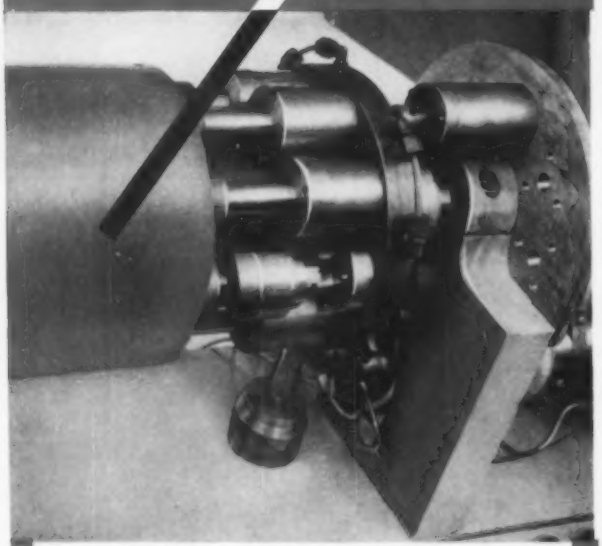

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ESPECIALLY DESIGNED FOR
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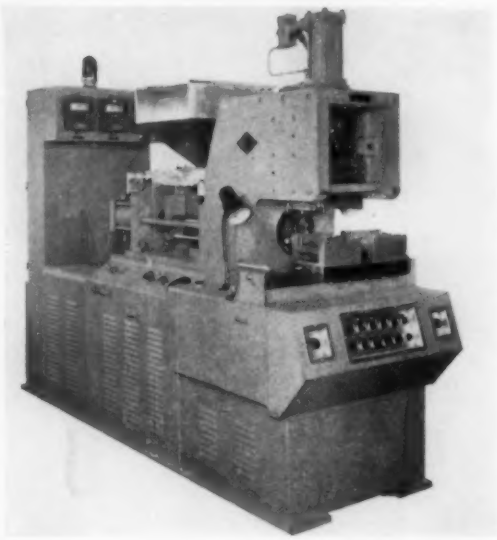

• The most advanced self containing semi automatic injection molding machine, fully hydraulic and special nozzle shutoff for non drooling. Designed to produce the maximum in Cordset harnesses—nylon parts—loose inserts.

• The Trueblood Unimatic is built in three sizes ranging from three to eight ounces.

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for preformed or premix molding of RP are included.

Thermoforming. This process is moving in two directions simultaneously. First, much bigger machines are being developed. Second, automation of small machines is being refined. And considerable interest is again being shown in coupling thermoforming machines to extrusion equipment.

Blow molding. Again, in consideration of the size and type of extruder or injection machine to be used, blow-molding equipment is moving in two directions. For continuous programs such as bottles, each plant setup now is likely to be individually engineered for the product and the material. And new types of equipment have been under development for really large blow-molded parts. Such equipment probably will be fairly standard in the industry.

Ultrasonics. Watch for one or more announcements of the application of ultrasonics to plastics welding or sealing. These new pieces of equipment, while presently fairly expensive, are extremely versatile and can handle many kinds of films and sheets.

Spray-up. In just three years this technique of producing large parts in reinforced plastics has become big business and new ideas for the process and its application have been generated. For boats, buildings, swimming pools, bathtubs and many other large items formerly laid-up, the spray-up method holds considerable promise.

The Engel process. This method of sintering small and large pieces of the polyolefins from fine powders in low-cost molds is just now being taken on by processors and will be of interest to many at the plastics shows.

Plastisol molding. Here will be evidenced refinement of well-established techniques for the production of a greater variety of products and the use of different materials.

Only a P. T. Barnum could find words to express the excitement and enthusiasm expected to infuse visitors to this year's plastics shows in June. From every part of the wide world of plastics to all other parts of that world will flow ideas for usefulness, efficiency, and profit the like of which has not before been seen.—**End**

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(1) For instance, there is Sterilkote Plastisol Series No. 100, a vinyl chloride based coating, specifically formulated for use in the hot dipping process. A free-flowing liquid, it will convert to a tough, resilient, abrasion-resistant, inert protective coating. It is used for coating racks, springs, hairclips, etc.

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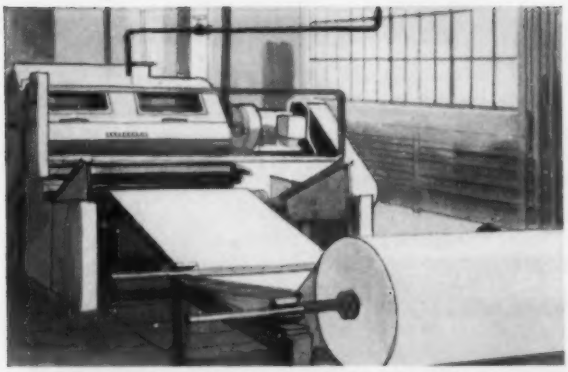

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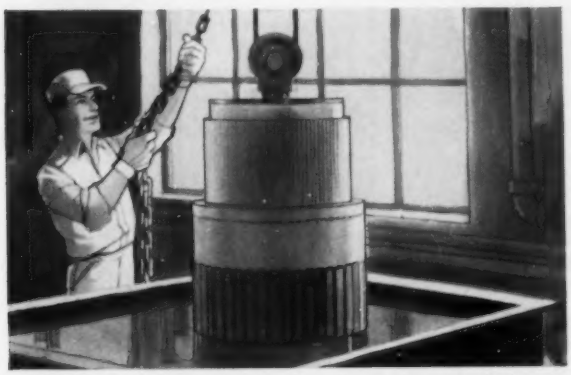

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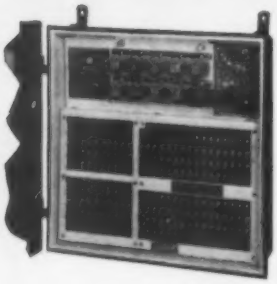

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International scene

(From pp. 139-141)

the first two. The potential of the Middle East-Africa area is long-term, and years must pass before important activity in the plastics field will be realized.

In the Asia-Pacific area, Japan dominates the scene as a plastics producer in much the same fashion as the United Kingdom does the "Outer 7." However, there are no organization trade agreements—so the area today, and well into the future, will probably remain orientated only by geography. Following World War II, there has been a tremendous resurgence of industrial activity in Japan, and in India and Australia. The economics there today far surpass anything visualized 20 years ago.

Of Japan's estimated 1.2-billion-lb. total plastics sales for 1960, over 40% is expected to be in thermoplastic products, and of these about 65% will be in polyvinyl chloride.

Next to the United States, Japan is the largest producer of PVC. Sales in 1960 are estimated at about 570 million lb., and are projected to grow to almost 900 million lb. by 1965. Japan is the world's largest producer of rigid polyvinyl chloride—low wage rates, coupled with cheap resin (under 14¢ per pound), and relatively high steel prices have created large uses for the unplasticized product in pipe and fabricated industrial vessels. Local Japanese building and construction codes permit extensive use of the rigid material. Over 35% of all Japan's PVC is used as the rigid product, compared with less than 3% in the United States.

The growth rate of polystyrene in Japan has been enormous. In 1952 imports amounted to 1.1 million pounds. After two polystyrene plants, associated with Dow and Monsanto, were established in 1957, local consumption expanded rapidly and now yearly output is on the order of 50 million lb., and in five years is expected to more than double that. Both companies have substantial expansions planned. A Koppers' associate will soon be in production, and at least one other firm contemplates polystyrene manufacture. Japan jumped on the low-pres- **(To page 285)**

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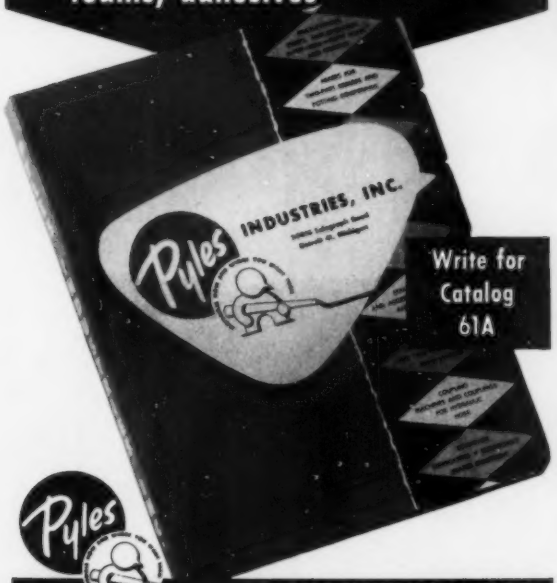

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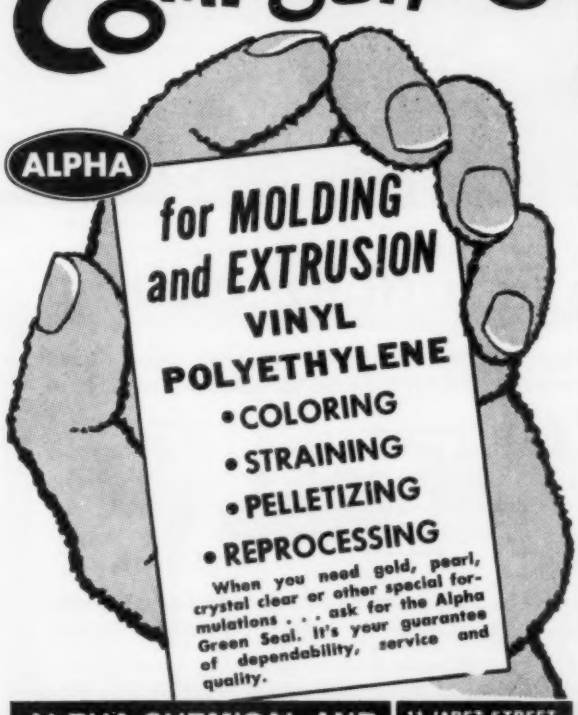
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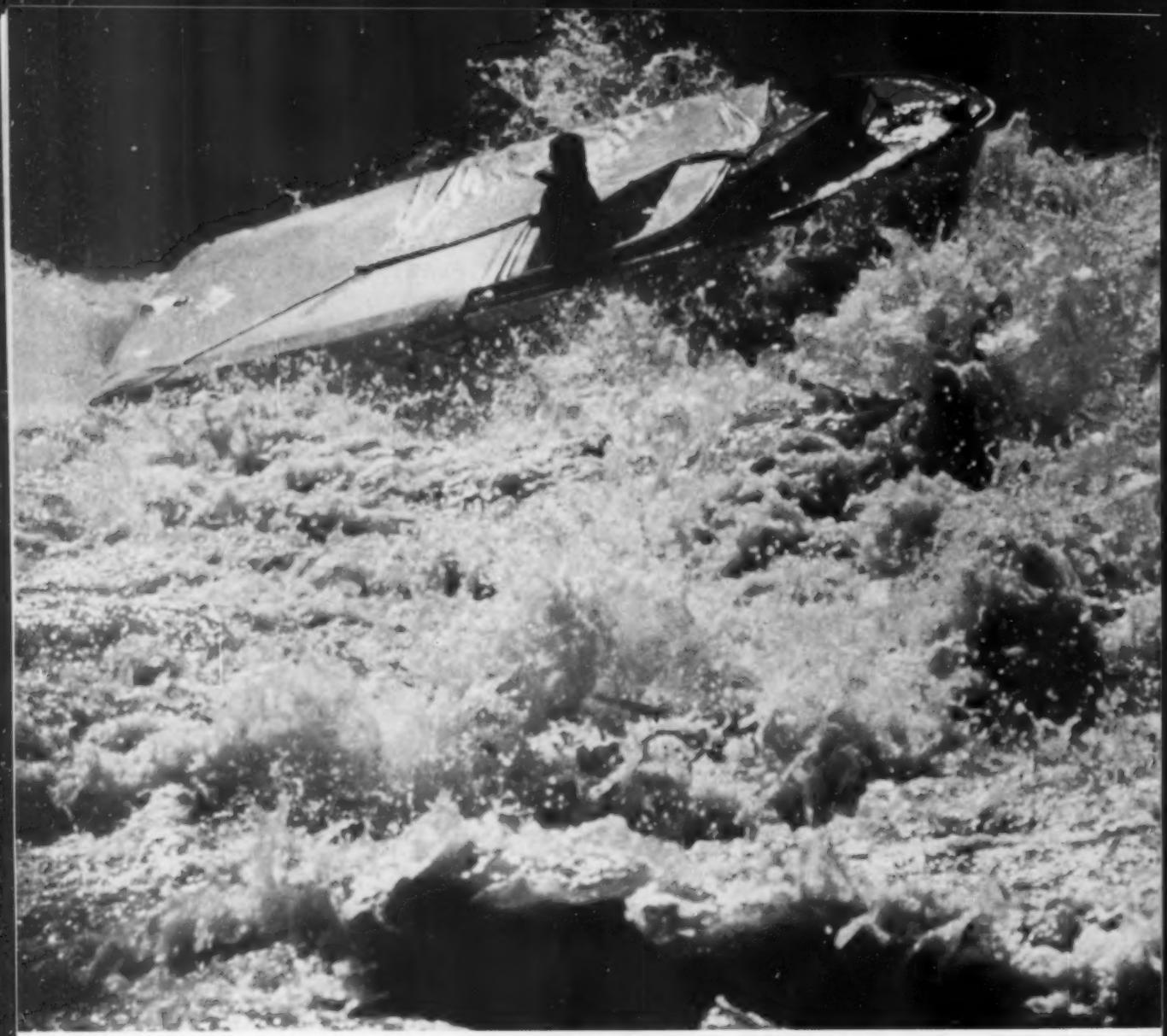

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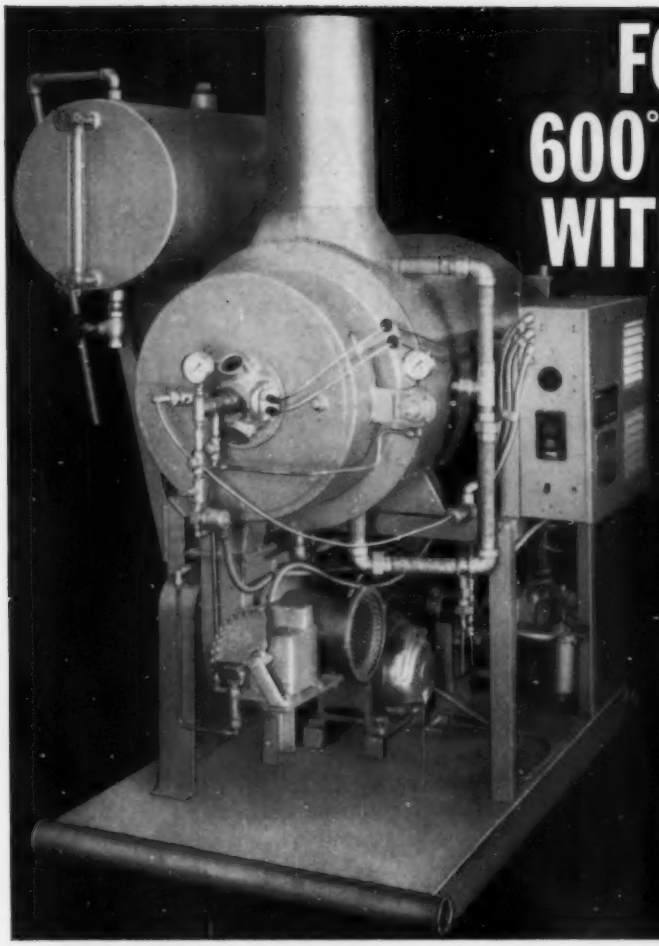

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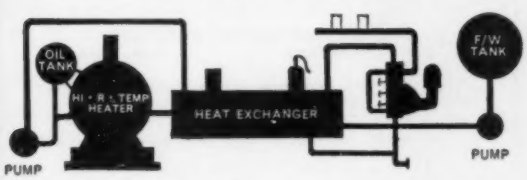

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sure polyethylene bandwagon early in the game, but it now is evident that the high-pressure product will dominate the Japanese polyethylene economy for many years. Installed capacities of over 120 million lb. are being increased, primarily for the high-pressure product. For the moment, however, demand outstrips local capacity.

While the major companies in plastics output are segments of the three largest former Zaibatsu organizations—Mitsubishi, Mitsui, and Sumitomo—U. S. firms are becoming factors in Japan's plastics industry. Included are Goodrich, through Japanese Geon in PVC; Dow, through Asahi-Dow in Saran and polystyrene and planned polyethylene; and Monsanto, through its interest in Mitsubishi-Monsanto producing PVC and polystyrene. Union Carbide and Du Pont have recently announced plans for the manufacture of polyethylene with Japanese associates.

In the remainder of the Asia-Pacific area, modest manufacture of polyethylene and polystyrene is under way in India. I.C.I., Union Carbide, and a Dow affiliate are active. India is plagued with an excess of chlorine, so planned PVC manufacture is welcomed.

And in Australia, polyvinyl chloride production by ICIANZ soon will be challenged by Goodrich, just as Union Carbide's subsidiary expects to challenge ICIANZ in polyethylene. Polystyrene is produced by subsidiaries of Monsanto and Colonial Sugar. Despite current activity in the plastics section, Australia's 10 million population is a serious limitation on the development of relatively large markets "down under."

Over-all, plastics potentials in the Asia-Pacific area are enormous, but are keyed to purchasing power, which is only slowly rising throughout the area.

Latin America

In Latin America, where all countries are really in the developing stage, the most rapidly expanding plastics activity centers in Brazil where PVC and polystyrene have long been made, followed recently by high-pressure PE produced by Union Carbide. Mexico and Argentina follow Brazil in plastics activity. Neither country

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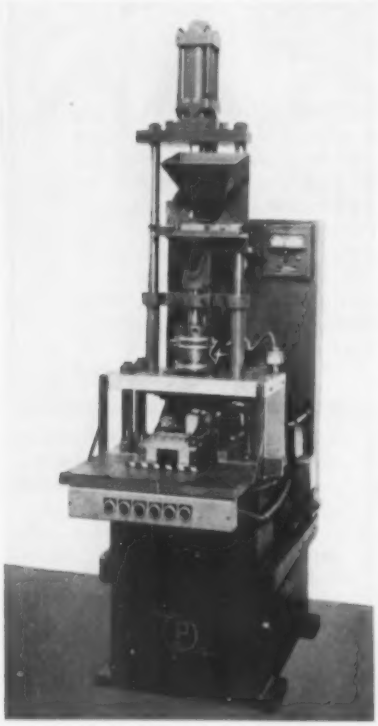

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has a polyethylene-producing facility at the present time, but these are planned. While imports have played an important part in developing Latin American markets, there is a strong trend to favor locally produced materials, and more manufacture on the scene can be expected.

Export to and manufacture in the Latin American area by American firms is fraught with problems, particularly because of inflationary conditions and currency and import restrictions, coupled with strong drives in many instances for Government to move into the manufacture of chemicals and plastics or raw materials needed for these products.

As is the case in the Asia-Pacific area, the key to increased plastics consumption in Latin America is purchasing power. The trend is definitely upwards, but volume potentials by American standards will be modest for a number of years to come.

Trend toward on-the-spot production

The strong trend world-wide is to build plastic-producing units in the specific market area. The example of the United States, with less than 1% of its plastics needs imported, points the way. Prompt action is needed by American producers to capitalize on plastics manufacturing opportunities abroad. Aggressive merchandising, coupled with strong market research and technical service—all of which are highly developed skills in the United States—must be used by American plastics producers who expect to export to the marketplace of the world. The challenge is there.

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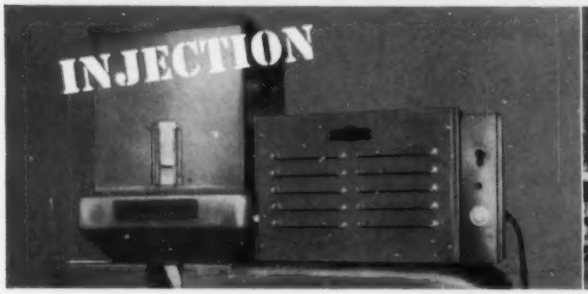

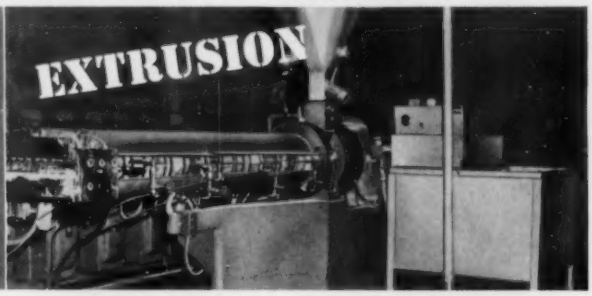

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England

(*From pp. 142-144*)

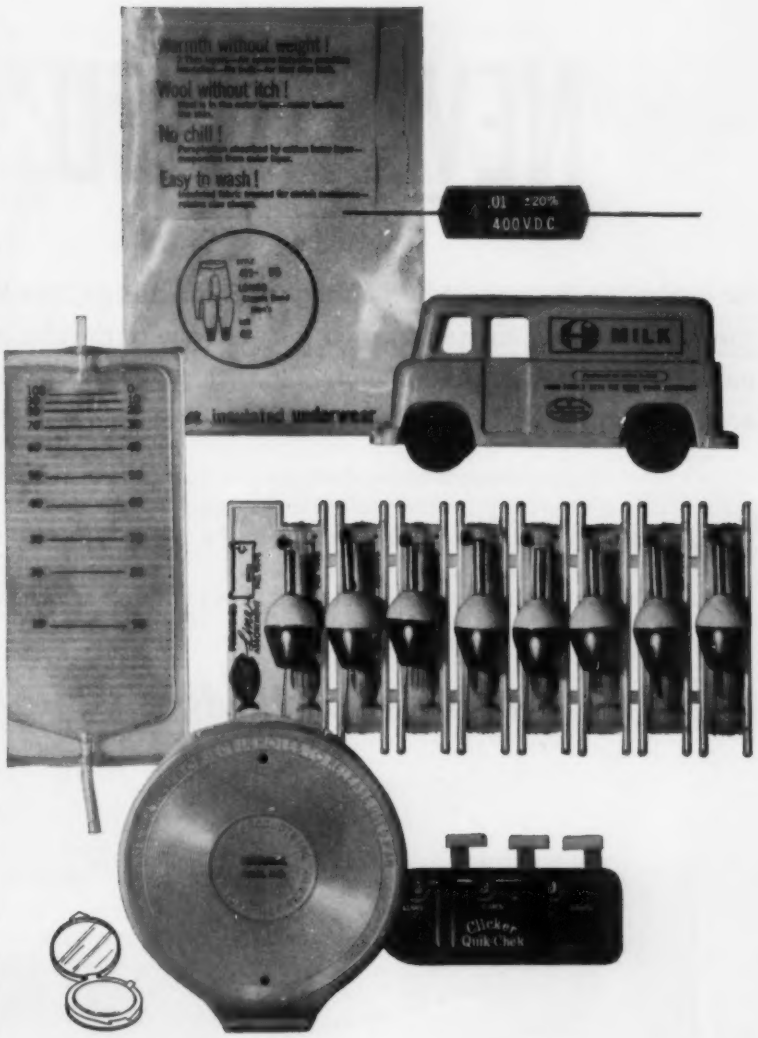
British market, particularly for applications that make full use of the material's rigidity and high temperature resistance. It now seems that it is proving competition for the thermosetting materials rather than, as was first thought would be the case, with other polyolefins. One example of this trend is the use of polypropylene for the top and the impellor of a domestic washing machine.

There has also been considerable interest in the low-pressure injection molding of inexpensive PVC sandals (photo, p. 143) and there is a growing interest in the possibility of producing shoes with PVC soles that could be used with conventional leather uppers.

In the last two years there has been a considerable upsurge in the reinforced plastics industry. Most significant new uses are in the transport field, where polyester resins reinforced with fibrous glass have found application in double-decker bus construction, larger-sized boats, railway carriage doors, motorcycles (photo, p. 144), and various other components of railway rolling stock. It is also worthwhile noting that there is now interest in the boat building industry in the use of rigid vinyl sheet that combines durability with ease of fabrication.

Tape made from polytryfluoroethylene (PTFE) coagulated dispersion polymer is being used for sealing pipe threads in building and other areas. The chemical resistance, low coefficient of friction, and non-stick nature of PTFE makes the jointing of screw-threaded pipes much easier. In the electronics industry there is now a developing use of copper-clad PTFE-glass cloth laminates for printed circuits.

Britain always holds a prominent position in the field of electrical cables and particularly in the design, manufacture, and laying of underwater communication cables. The laying of a polyethylene-insulated trans-Atlantic telephone cable some years ago has stimulated design activity, and, at the present time, production of a refined version of under-ocean telephone cables is under way.—**End**



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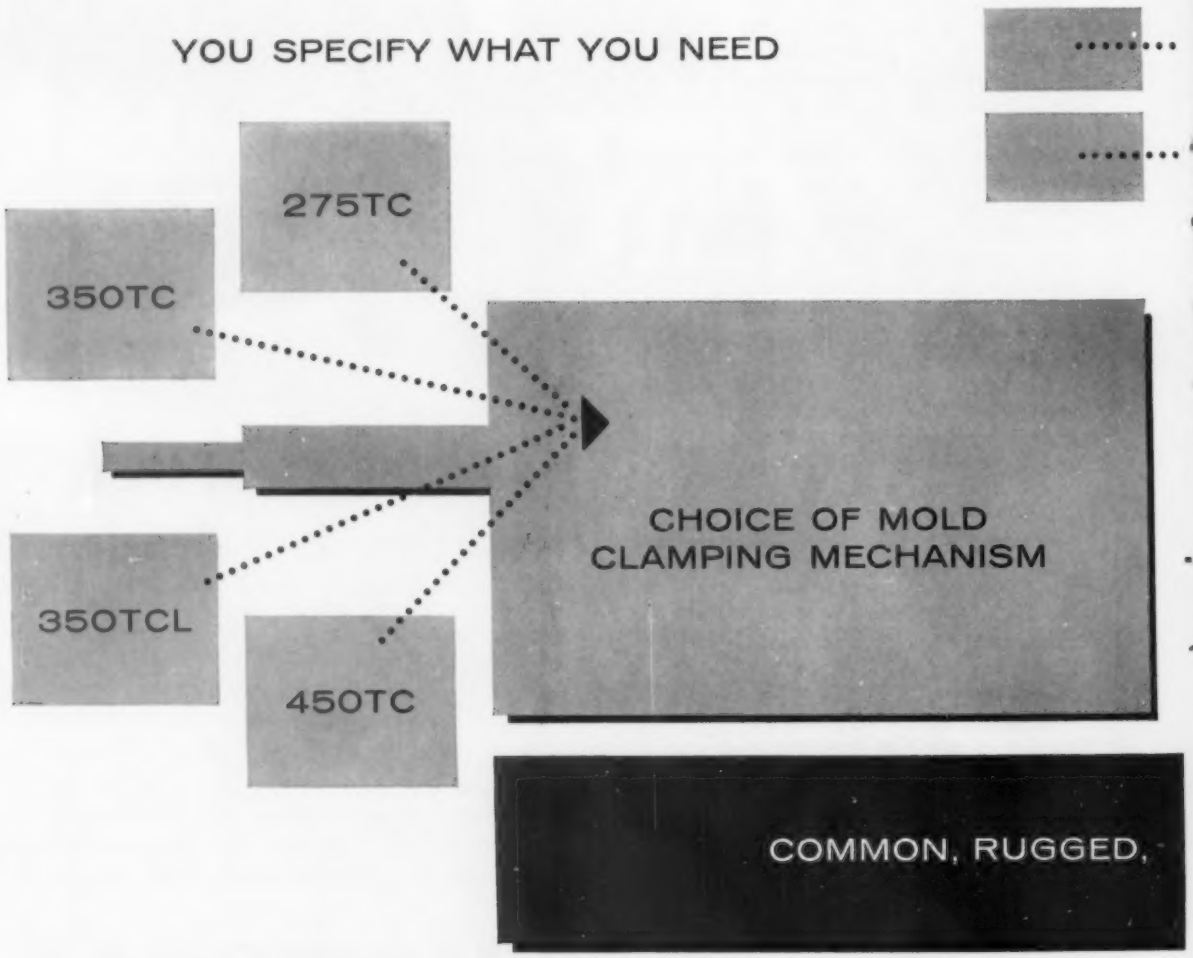

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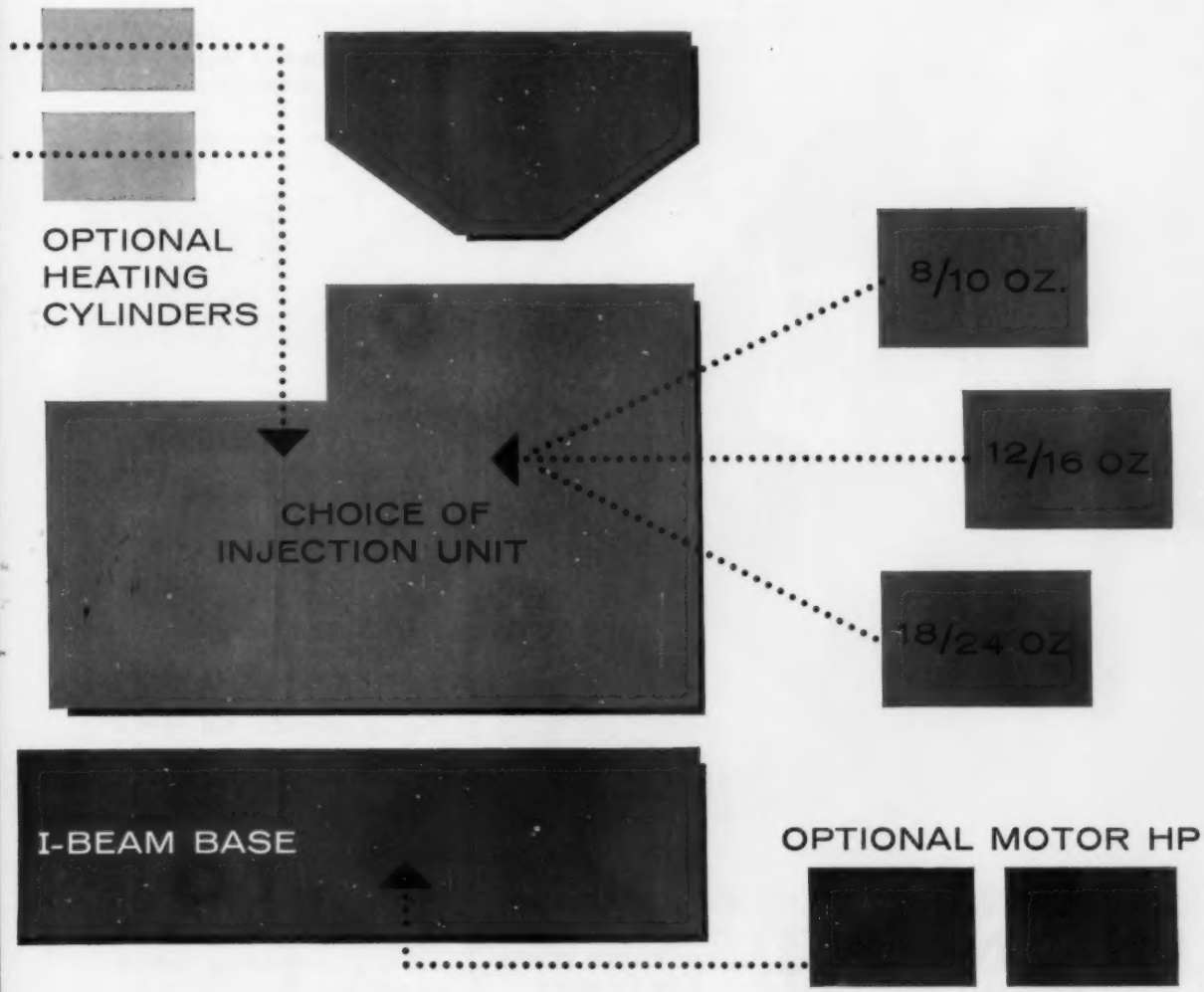

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West Germany

(*From pp. 148-150*)

completed by bonding RP circular disks onto the ends of the molded cylinder. Storage vessels produced by this technique in capacities between 2000 and 20,000 liters (approximately 500 and 5000 gal.) are already in wide use in West Germany.

Polyurethanes: In the case of crosslinked polyurethanes, considerable success has been achieved in improving properties not only of flexible foams but also of rigid foams. In the latter area, instead of the polyester types previously used, manufacturers are experimenting with polyethers of greater or lesser branching which, because of lower viscosity, are considerably easier to process.

Rigid foams based on a new isocyanate component (Desmodur 44 V) are characterized by increased toughness and better adherence to surfacing materials. Desmodur 44 V should also help boost the use of spray-on foams for insulation purposes in home construction, boat building, as well as in container manufacture.

Polyurethane elastomers, based on Desmophene A, have been developed which can be processed on conventional rubber-processing equipment. In this way, shapes, tubes, etc., can be made which offer properties similar to those of Vulkollan.

Melamine-phenolic: The big news in the field of thermosets is the introduction of a melamine-modified phenolic molding compound, available in a wide range of colors. In mechanical and thermal properties, they correspond closely to phenolic molding compound Type 31. Moldings based on the material are free of taste and odor and show no tendency to crack even under fluctuating thermal stresses. They are expected to find use in a number of applications now involving phenolics which have to be varnished and baked subsequent to molding in order to obtain a desired color effect.

Processing developments

In injection molding thermoplastics, a significant step forward has been made through use of the extruder screw as a **(To page 297)**

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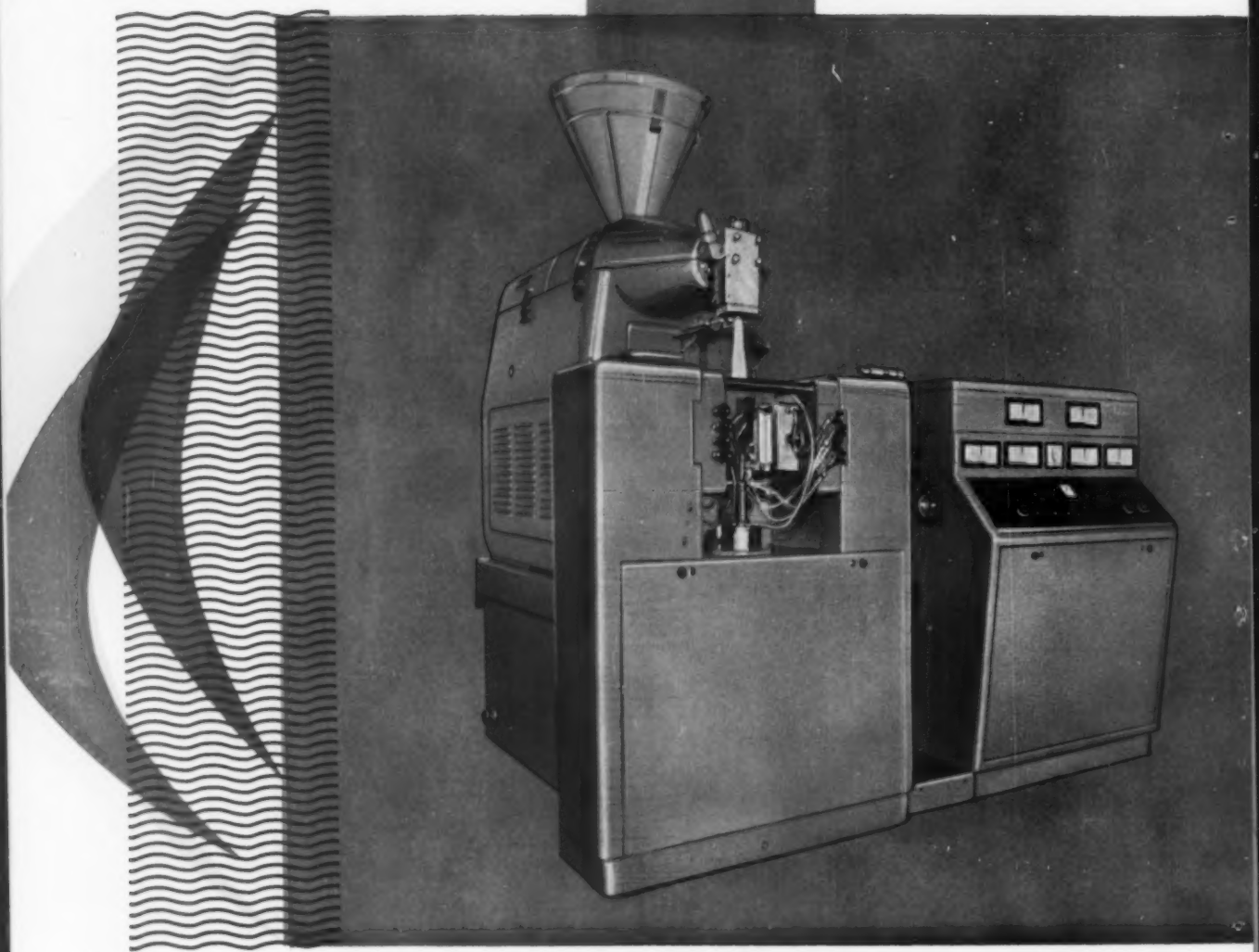

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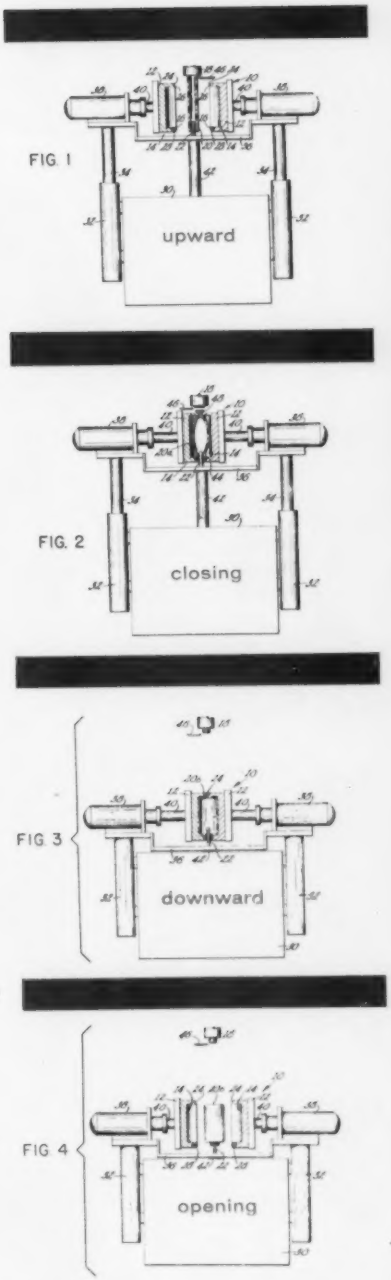
as shown in the diagram at right,

which is subject to U.S.-Pat. 2.975.473.

This should be interesting news to

any user of blow-moulding machines.



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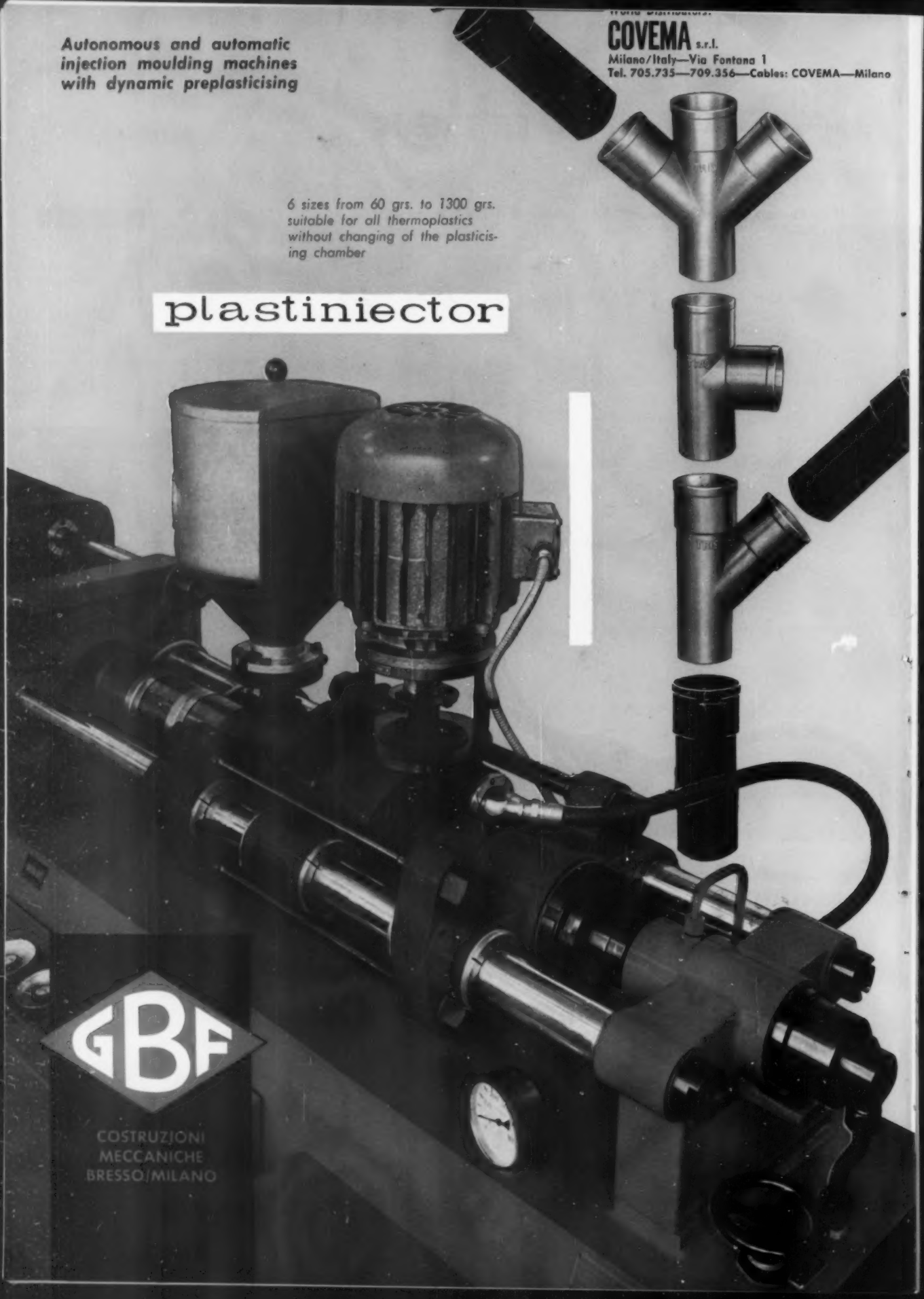

plasticating mechanism in injection molding machines—in one case the reciprocating mechanism has a screw which also doubles as the piston, and in the second case, a screw preplasticator is utilized with a conventional piston injection-molding system.

Advantages as compared to conventional injection machines lie in the fact that the resin melts homogeneously and quickly. This means that the cylinder retention time is shortened and temperatures can be increased in order to obtain a better flow.

Plastics which are sensitive to heat, *e.g.*, rigid PVC, are thus easier to fabricate. At the same time other plastics that could not heretofore be injection molded, *e.g.*, polytrifluorochloroethylene, can be processed on these new machines. The high plasticating capacity also facilitates the production of larger parts. Shots of 10 to 20 kg. (approximately 22 to 44 lb.) are currently possible.

In reinforced plastics, the big news in technology is the use of the spray-up process to replace hand lay-up in the production of large parts on a mass-production basis. Equipment is available to simultaneously spray chopped fibers and one or more resin components (in adjustable amounts) into or onto a mold. In addition to moldings, the equipment can also be used for other applications, such as seamless linings for containers, wear-resistant road markings, and corrosion-resistant coatings and insulations for all types of building construction purposes.

One interesting processing development in Germany is the so-called Duroplast thermoset injection machine. Molding compounds of a paste or putty composition (*e.g.*, polyester and acrylic resins mixed with glass fibers, asbestos fibers, etc.) are loaded at room temperature into an injection cylinder, then injected into a hot mold. The injection system feeds the material into a section of a rotary mold table which can accommodate from 2 to 6 molds. As each mold is filled, it moves away from the nozzle and the material cures as it makes its way to the ejection station (speed of the rotating table can be adjusted to required curing times).—**End**

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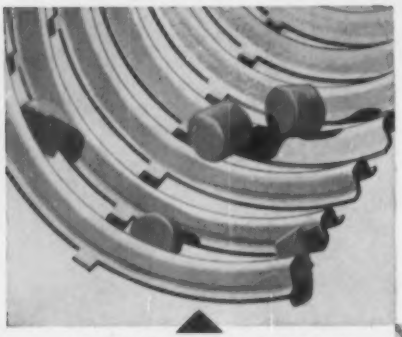

PRECISION GRADERS SEPARATE MATERIAL BY THICKNESS

For sizing and separating free-flowing granular materials by *thickness*, Carter Precision Graders use revolving cylinders with slotted perforations. Material placed in these cylinders is upedged and presented to the slots in an edgewise position. The thinner pieces pass through, and the thicker pieces pass over and are conveyed to the end of the machine.

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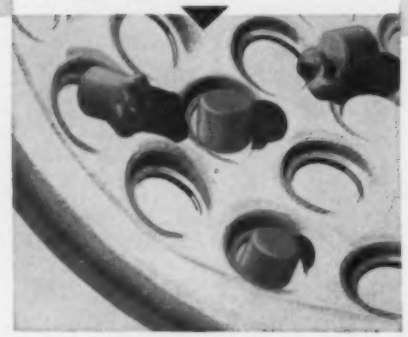

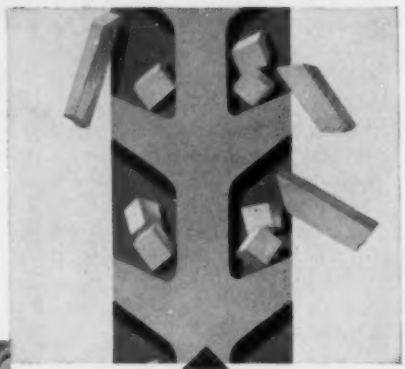

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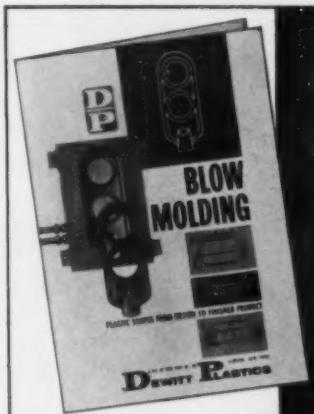

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Italy

(*From pp. 152-153*)

absorbers, mud guards, seats, chain guards, luggage pockets, light housings, rear-view mirrors, and other similar applications.

Much of PP's success in the home appliance field is attributable to its high gloss, hardness, good color, and lower cost. Hair dryers, coffee mills, housings, and parts of vacuum cleaners and floor polishers, electric fans, washing machine parts, television housings, etc., are but a few of the many applications that have opened up in this field.

In housewares, such items as dishes, bowls, bread baskets, tumblers, buckets, baby baths, and chair backs and seats are now being made of polypropylene. The textile industry utilizes bobbins, bench tubes, cogs, etc., made of polypropylene because this material is unaffected by the high humidities, high temperatures, and dyestuffs common to textile manufacture. Applications in the sanitary wear field are continually increasing, and such items as syringes, sterilizers, and bed pans are among many hospital items currently being produced.

The chemical industry is the largest consumer of extruded PP sheets for such items as tank liners, gas ducts, gas purifying towers, etc. Monofilament has just begun to make its appearance in ropes, filter fabrics, furniture, cable covers, and hem trim for use on ladies' bouffant petticoats.

Food and soft goods packages are using polypropylene film—both non-oriented and bi-oriented—for items ranging from fish to underwear. Potential consumption of this plastic film by these industries is almost limitless.

Another large-volume use is in the production of heels for womens' shoes; here polypropylene has replaced wood and other plastics. More than a dozen molders are currently making shoe heels with polypropylene resin.

Polyethylene, both low- and high-density types, has large markets in Italy. Most significant is the remarkable increase in blow-molded containers for bleaches, detergents, and liquid chemicals; and in film up to 25 ft. in width for use in construction and agriculture.

Polystyrene production has also been increasing due to a rapidly expanding market for refrigerators. Styrene sheets for refrigerator door liners are now big business in Italy. One unusual impact styrene product recently introduced is a kitchen cabinet unit molded in modular sections that fit together in any desired arrangement. One notable volume outlet which consumed more than 3000 metric tons of polystyrene in 1960 is the export fruit business, which uses thin vacuum-molded sheets as separators to prevent bruising of fruit and produce in shipment.

ABS and methacrylate resins—though only in production for about a year—are already being used as housings for business machines, in various automotive applications, in housewares, etc.

Polyester glass is moving at a steady pace into the construction of corrugated panels, boats, containers, and many technical and decorative applications.—**End**

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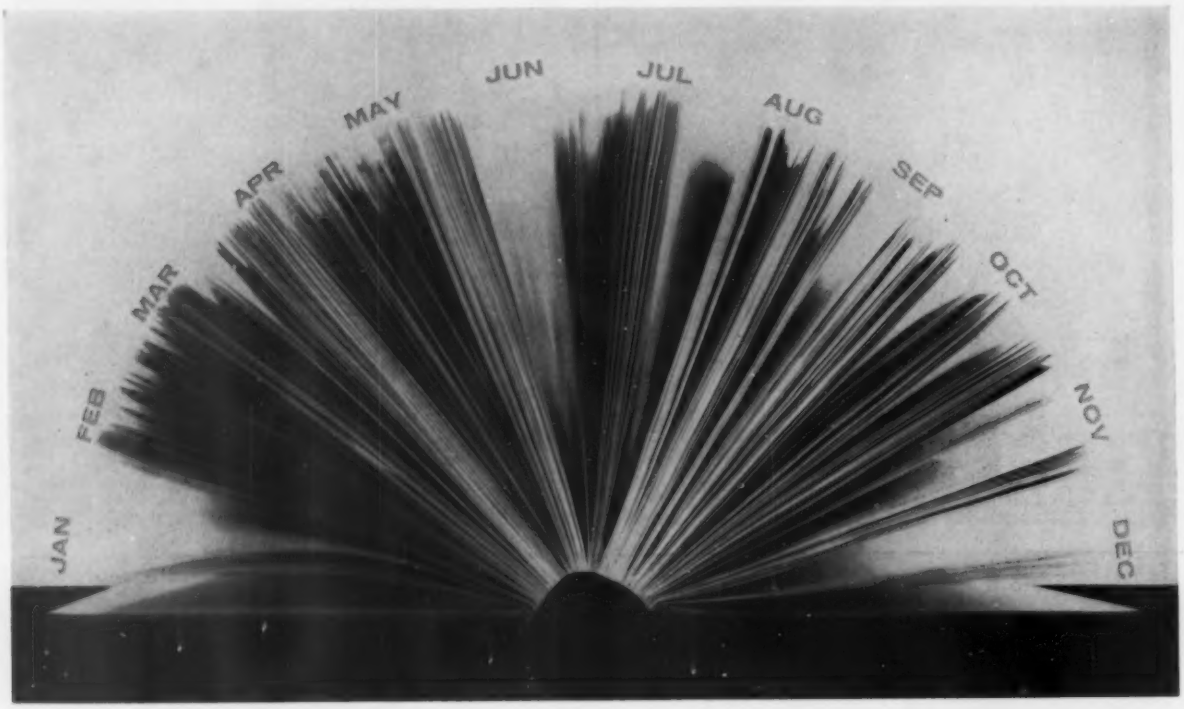

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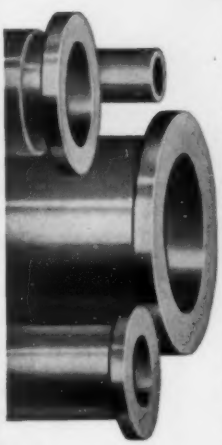

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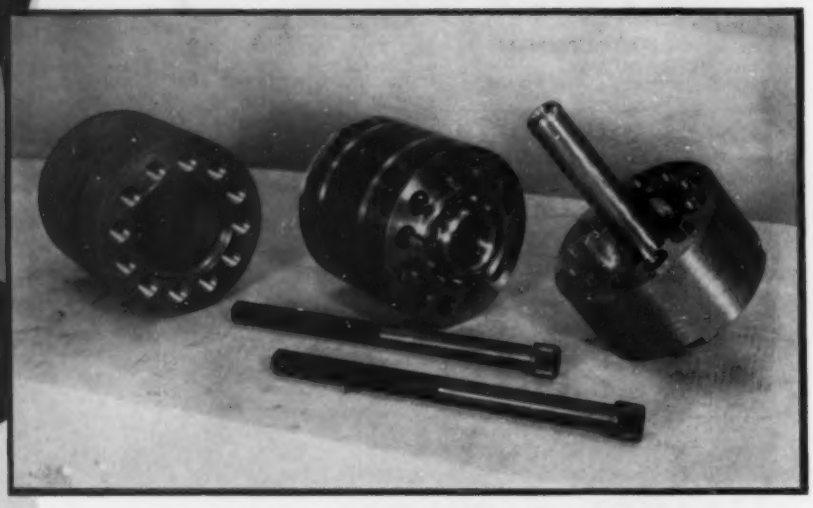
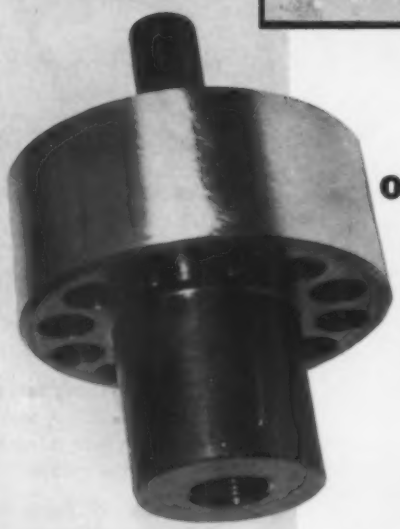
DEGASSING

HEATING CYLINDERS





Easy to take apart!
They mold <u>everything</u>
on <u>any</u> make of injection press!

IMS Design Bolted Heaters are another weapon in our arsenal to combat your injection machine heater problems...no matter what your make or model of press!

IMS Exclusive Degassing Cylinders lend themselves ideally to the Bolted Design. Mold better parts free of gas marks, splashes, silver streaks, mica spots and are ideal for vinyl work or where field cleaning is necessary. The built-in automatic Degassing feature improves performance up to 50% and gives longer cylinder life in the molding of acid containing or thermally difficult materials.

Get rid of strains, burns and welds by Degassing your plastic! No valves...no moving parts, yet gas relief is automatic.

DON'T BUY YOUR OLD HEADACHES ALL OVER AGAIN!

Next time you have a heater problem...call IMS! Take advantage of our *Heater Redesign Service* to upgrade your press plasticizing capacity and cut your cylinder downtime.

Free

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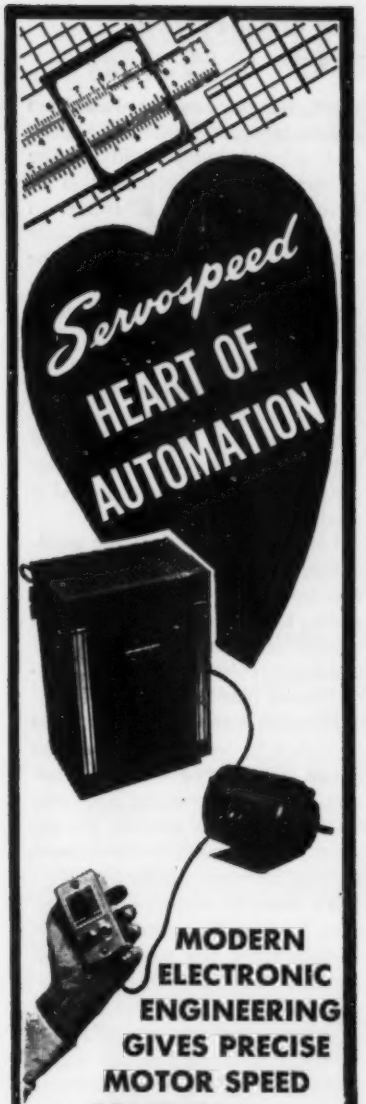


MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J.
ARmory 4-8989

Foam fabric

(From pp. 162-164)

which have recently made a bid for the market, can be used. These low-temperature agents, which produce an open-cell foam structure, decompose at 212° F. and foam prior to plastisol gelatin, which is 220° F.

Versatility plus

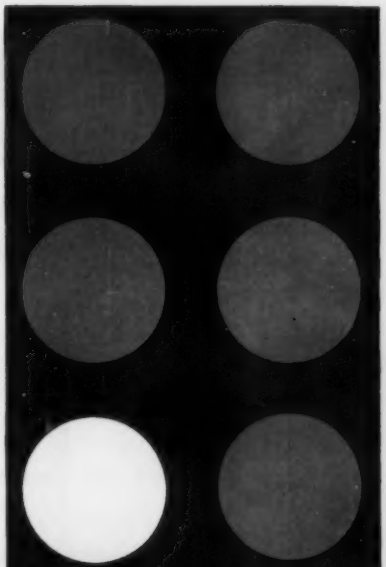
No matter which technique is used, the amount of blowing agent needed to effect the construction is relatively low. It is estimated that no more than 3% is needed for calendering and between 1 and 1½% for dispersion coating.

The thickness of foam core and vinyl skin can also be closely controlled. In general, the construction for outerwear garments involves a 20- to 30-mil core and a 3- to 5-mil skin; for upholstery applications, the core can go up to 40 mils or higher and the skin is up in the 6- to 10-mil category.

The density of the foamed core is about 15 to 30 lb./cu. ft.—and this is one of the paradoxes of the system. Unlike other foam systems which try to cut density, the manufacturers of vinyl foam-coated fabrics look for this higher density to give their product better hand and feel. It is one of the competitive edges they expect to have in relation to urethane foams which, because of cost, have to go lower in density when used with fabrics.

Embossing techniques with the foam-coated fabrics differ from conventional ones in that only the top surface of the laminate is heated and very light roll pressures are used. Deep embossing, such as tufting or quilting, is easily accomplished with heated rolls or by dielectric means. Deep grain patterns require the use of more deeply etched rolls than are currently employed for the straight vinyls.

Credits: Azodicarbonamide agents used for making calendered and cast foam-coated fabrics include U.S. Rubber's Naugatuck Chemical Div.'s Celogen AZ and National Polychemicals Inc.'s Kempore R125; NTA agents for cast foam-coated fabrics include Du Pont's Nitrosan. Article is based on information supplied by U.S. Rubber Co., producers of Doe-Lon vinyl foam-coated fabrics, and by The General Tire and Rubber Co., Bolta Products Div., producers of Vinelle and Boltaflex-400 foam-coated fabrics.—**End**



DIFFERENT?

Let's assume that these circles represent your product and five competitive products. There may be no significant difference in design, concept, operation, or construction, yet, one catches the eye more than the others. We've represented this stand-out product by the white circle —it's not really different, it just looks different.

If your product had this ability to capture more attention than competitive products, wouldn't your sales benefit? Of course. And, you can build this type of difference right into your product. Here's how:

Nacromer® SYNTHETIC PEARL ESSENCE

MURANO®

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Both of these materials will complement your product designs with luster effects and a depth of color impossible to achieve with conventional dyes or pigments. With Murano, for example, you can obtain a multiple color play which verges on the iridescent. They can be incorporated into plastics or used as a coating on almost any material.

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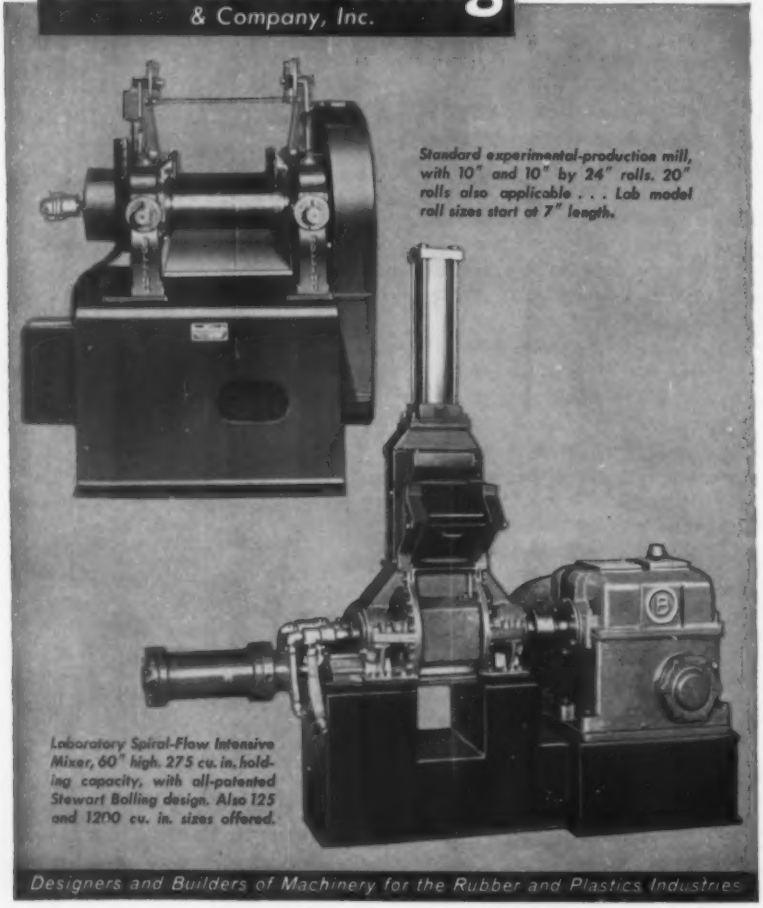


Standard experimental-production mill, with 10" and 10" by 24" rolls. 20" rolls also applicable . . . Lab model roll sizes start at 7" length.

Laboratory Spiral-Flow Intensive Mixer, 60" high. 275 cu. in. holding capacity, with all-patented Stewart Bolling design. Also 125 and 1200 cu. in. sizes offered.

Designers and Builders of Machinery for the Rubber and Plastics Industries

RP engineering

(*From pp. 165-167*)

travel. It is obvious that abuse from rough landings, buffeting waters, and ground bumps will require an unprecedented combination of strength and resistance factors in a single body structure. Not only will a lightweight body material be essential in the future but weight saving *here* and *now* is a cumulative blessing. A pound saved in the body shell permits you to use a smaller and lighter engine to accelerate the car, smaller and lighter brakes to stop it, smaller and lighter tires to support it, a smaller freight bill to transport it, and a smaller fuel bill to run it.

Let's look at some af the possibilities in tomorrow's transportation and see how growing requirements for low density and high strength increase the probability of a definite switch to fibrous glass-reinforced plastics.

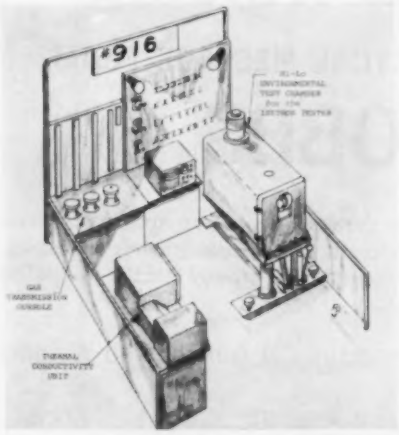
Flotation systems, which may be important in some vehicles of the future, need not be added appendages, since they can be built into the body, possibly through the application of specially formulated sprayed-on foam sandwiches.

Air foils, in smooth-flowing designs and easily maintained polished surfaces, will be needed and available in low-density, high-strength plastics.

The Uniwheel car is clearly predictable. The necessity for lightweight functional design is essential since that conveyance will be held upright by gyroscopic devices. This Gyro-Car, operating on a single massive tire, must be built for maximum strength and minimum weight in order to provide room for the electronic gear which most of our future cars are likely to contain. The tire, with a projected tread life of 200,000 miles, could well be cast from a liquid resin resulting from a chemical reaction between a polyether glycol and a polyisocyanate, reinforced with a two-phased glass fiber and incorporating a tread coating of fluorocarbon resin.

New types of power systems are matters of top priority today. These systems will be highly efficient in their energy conversion, weight factors, or both. Some of these power systems **(To page 308)**

MEET US AT BOOTH



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This NEW 3" x 8" THROPP MILL *expedites* rubber and plastics research

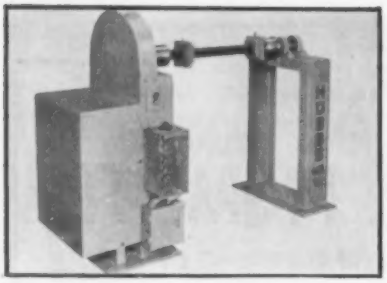
Aided by many years of experience in designing laboratory mills, Thropp engineers have developed this up-to-date 3" x 8" model. It sets new standards for attractive modern design, compactness and economical maintenance.

The new mill, designed for processing small batches, is one of the Thropp family of rubber and plastics mills, ranging in size up to 84". The machine has tilting type guides to facilitate thorough and rapid cleaning and prevent carry-over of color or other contamination to subsequent batches.

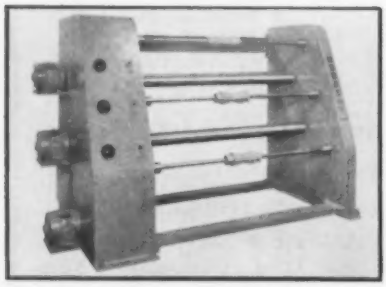
Manufacturers who appreciate the importance of fast, accurate, economical research and development work will find this machine a sound investment. Send for further information.

Wm. R. THROPP & Sons

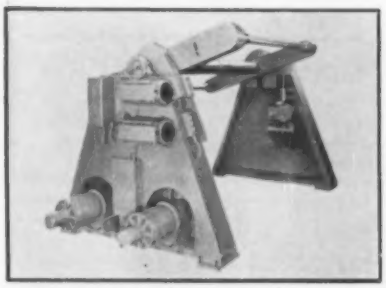
Division of J. M. LEHMANN COMPANY, Inc., 551 NEW YORK AVE., LYNDHURST, N. J.



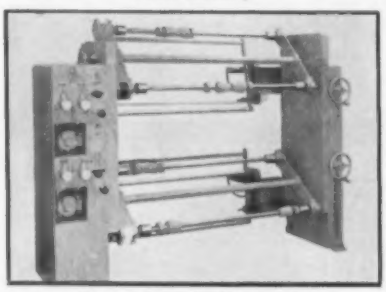
Light Duty Single Shaft Winder



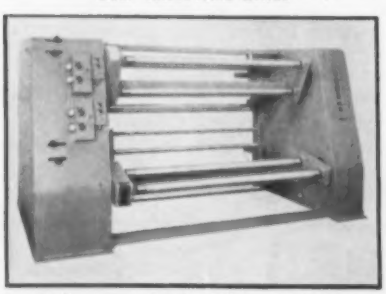
Medium Duty Staggered Three-Shaft Winder



Heavy Duty Two-Shaft Turret Winder with Power Indexing



Light Duty Duplex Winder with Dual Vers-A-Wind Drives



Medium Duty Duplex Winder with Dual Vers-A-Wind Drives and Power Indexing

Looking Ahead in Web-Winding

A TIMELY FACTUAL MESSAGE FROM

HOBBS

With the general business curve again on the upturn and with the corresponding development of immediate needs for capital equipment, Hobbs Manufacturing Company felt the following facts might prove helpful.

How Fast Can Your Company Get Quality Web Winding Machines?

The answer Hobbs has is "Very Fast!". However, Hobbs does not and will not sacrifice the principles of sound engineering of machinery for your particular need in order to short-cut delivery. Hobbs has the man-power and the system to get your quotations to you promptly and accurately wherever you are . . . and Hobbs delivers the equipment it engineers — *as engineered.*

What Makes Hobbs Your Best Source For Web Winding Machines?

The heavy concentration Hobbs places on this machinery and the depth of experience it enjoys in the design and manufacture of web winding machines for plastics, paper, rubber, textiles, etc. make it a source which should always be considered in the purchase of this equipment. Further, Hobbs offers eight basic designs of center shaft web winding machines all of which can be modified to suit your particular requirements.

More For Your Money Now Means More Than Ever

Hobbs has stated that through its superior web winding machine design and engineering it gives customers "more for the money". Now this Hobbs sales theme means more than ever when the requirement is for high quality output machines for competitive prices. Hobbs does not cut price or quality but *does deliver* MORE WEB WINDING MACHINE FOR THE MONEY.

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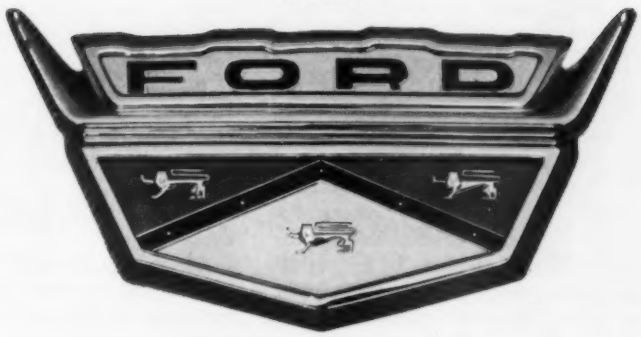

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will demand high-strength, high-temperature-resistant materials.

Advanced manufacturing techniques will enable tomorrow's engineers to incorporate many functional parts in the auto body. It will be possible to integrate entire exhaust systems (if exhaust systems are still used) into the body. The muffler might be composed of glass fibers or fibers of advanced heat-resistant substances such as titanium salts, which might be consolidated into the plastic matrix.

Spring torsion-bar systems will become an integral part of the body, since it has already been demonstrated that strength and elastic properties of glass fiber-reinforced plastic materials have made possible such highly stressed applications as springs. Picture a body shell of reinforced plastics moving down a computer-controlled assembly line with spring and exhaust systems already fabricated into the structure. The electrical system could then be added by means of a printed circuit which could be automatically printed on to the plastic body structure. As you know, glass fabric-reinforced plastics already are the standard material for printed circuit boards. In addition to the printed circuit, it is not inconceivable that certain other advances, contributed by "solid-state" physics and the astonishing electronics industry, could result not only in the distribution of electrical power through the body but also in accomplishing the function of electro-mechanical generators, relays, and other circuit devices. These might be carried out as solid-state reactions within materials molded into the plastics body.

If our futuristic car contains the engineer's dream of *one single fluid* for all of the cooling, braking, steering, and other power functions, the single master fluid will undoubtedly be sealed into a plastics unit molded into the body structure. This would involve integration of molded-in duct work, which could be pre-formed into the structure.

Modern styling

In your new concept of tomorrow's cars, let us now contemplate the radically new styling effects that might be obtained through the use of reinforced plastics. New configurations will be possible in plastics that heretofore could not be fabricated in steel.

It is also conceivable that not only color but surface finish can be impregnated into the reinforced plastic material during the molding of the body shell. Such wax-like impregnations might be chemically devised to migrate gradually to the surface, and provide the car with a perpetually attractive finish.

In the area of esthetics, certain built-in lighting effects could be accomplished by day or night. It would become possible to style a permanent bubble-top which could be either semi-transparent, translucent, or completely opaque by controlling the polarization of light that would otherwise be admitted into the car.

Interesting lighting effects could be accomplished not only by light conduction, diffusion, panel-glowing light bars, but also by electroluminescence of certain plastics materials, containing the proper excitable salts.

The rapidly advancing electronic sciences will no doubt prove to be useful in the regulation of future automobile traffic. Plastics auto bodies, transparent to radar or magnetic contact, may be operated by a driver or automatic pilot, constantly guided, or even controlled, by electronic signals.

Our hypothetical car of the future may not yet be on the drawing board. When we do reach this stage of evolution, it is our prediction that structural plastics will play a major role in the engineering of its body.

It is important, though, that we realize that vast increases in the use of plastics for car bodies need not wait for revolutionary changes in power plants or transportation patterns. We have all-plastics sports cars today. We have mass-produced body components today. The great industries concerned need to devote their resources of money and imagination to further utilization of reinforced plastics' evident potential. The inevitability of high-strength reinforced plastics materials in future automotive design is an exciting challenge and a unique scientific opportunity for creative designing and engineering. We are on the road to a fascinating future. The signposts are clear.—**End**

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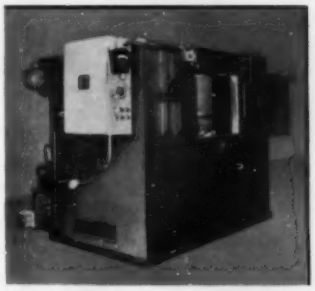
(in aircraft, autos, construction, electrical, industrial, household, toys, etc.)

"ECONOMY" equipment for hollow parts molders makes large or small production easy on short notice. Minimum cost tooling is quickly obtainable. The flexibility of "Economy" professional heavy duty machinery helps meet changing market needs. Jobs that are *un*economical for ordinary metal working or molding may be profitable in cast thermoplastics.



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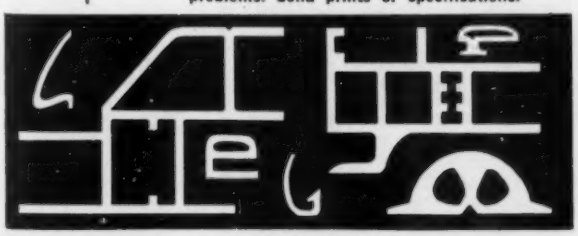

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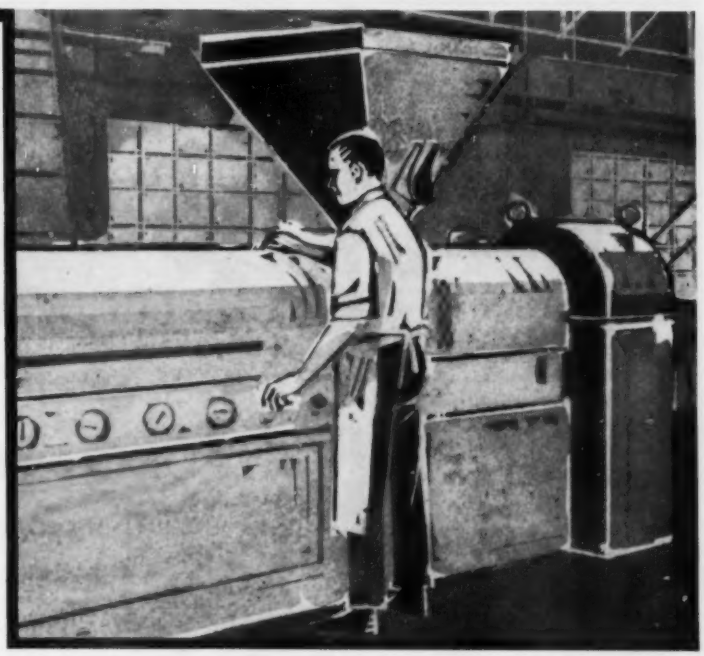

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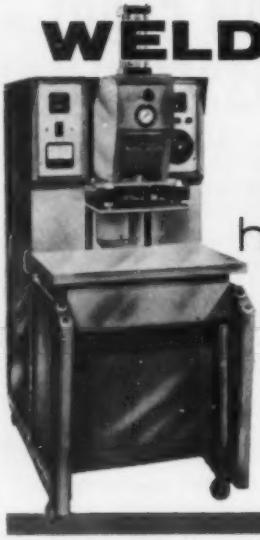

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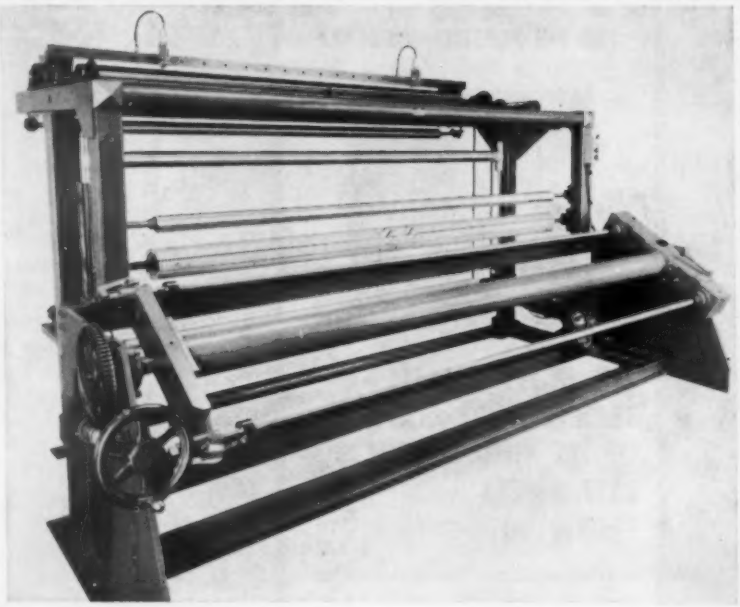
With the new Faeco Heavy Duty Turret Center Winder for use on printing presses, embossers, casting machines, calenders, laminators, coaters, etc., where heavy duty rolls are involved and tension control is important.

This model TW 250 H Turret Center Winder insures equal tension from beginning to end of run . . . eliminates slack, tightness, distortion . . . solves a multitude of winding problems. It is available in web width capacities from 60" to 120".



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Floor scrubber-waxer

(From page 170)

Again, chemical resistance, as well as stiffness, heat sealability, and dimensional stability, motivated the selection of plastic.

Polyethylene, medium density, was used for the wheels to assure smooth passage over rugs without catching or snagging the fibers. The shampoo-polisher's wheels are injection molded in a 6-cavity, disk-gated, hot-runner mold.

HIGH-DENSITY PE squeeze bottle is resistant to petroleum-base waxes; translucency shows level of supply.

Acrylonitrile - butadiene - styrene (ABS) put its toughness, good dimensional stability, and excellent electric insulating properties to work in six injection molded parts: wheel carriage, tank support (H), handle control lever insert (I), tank valve, bail insulators, foot control lever insulator. The ABS parts are unaffected by atmospheric conditions, humidity, or heat—even the heat that builds up in a glass-enclosed showroom where the appliance might be on display. And it is notable that most of the parts that were made with ABS are those that would be subjected to stress during the normal operation.

Impact styrene serves for the backs of two sets of brushes (J)—one for shampooing, the other for scrubbing. The material is tough enough to take the stresses of high-

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speed rotation without cracking, strong enough to support the entire weight of the appliance (when the brushes are used, the wheels lift off the floor), flexible enough so that the backs can be snapped onto the brush holders—and low in cost.

Phenolic was chosen for compression molding the shampooer brush body housing (K), first because the size and weight of the unit made a thermoplastic impractical by virtue of the long injection molding cycle that might be involved, and second because of phenolic's resistance to the effects of commercial rug-cleaning compounds. Handle plug and switch housing are also molded with this plastic resin.

Cellulose acetate was chosen for the largest piece—a motor hood (L) that weighs over 12 ounces. Low cost and toughness were two of the motivating factors. A third was inherent in the fact that the mold for this part was originally designed for the hoods of earlier models, which at that time had to be made of a flame-resistant formulation of cellulose acetate to meet U/L standards. Although other flame-resistant plastics were now available, they could not be adapted to the mold. So, to amortize the cost, Hoover chose a less expensive cellulose acetate formulation which could then be spray-painted on the inside with a flame-retardant coat in order to meet U/L standards.

Polyvinyl chloride, offering flexibility, good aging characteristics, integral coloring, and excellent insulating characteristics, showed up in the bumpers (M) that protect furniture from being scratched by the appliance and in cord covers (N), tubing (O), plug, foot lever pad, and handle insulator.

Credits: Polypropylene supplied by Hercules Powder Co.; ABS by Marbon Chemical; high-density polyethylene by Hercules and Phillips Chemical Co.; medium-density PE by Eastman Chemical Products and Union Carbide; styrene by Dow; phenolic by Durez Plastics Div., Hooker Chemical Co.; PVC supplied by B. F. Goodrich and Monsanto, dry blended and compounded by Hoover. Wax bottle dispenser cap supplied by Polytop Corp., Hingham, Mass. Squeeze tank blow molded by The Campro Co., Canton, Ohio. Flame-retardant paint for hood furnished by Albi Mfg. Co., Rockville, Conn.—**End**

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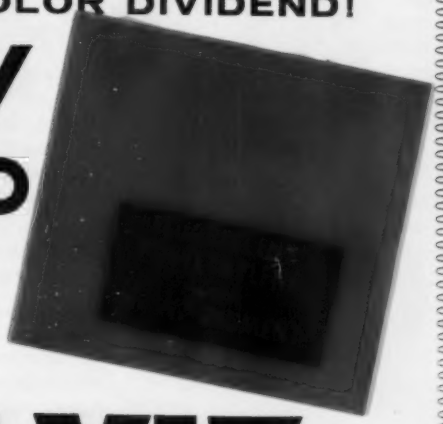

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Drink dispenser

(From page 169)

six basic parts: 1) a stainless steel ice-chest body to which 2) a cast aluminum cold plate is joined; 3) upper and 4) lower halves of the molded acrylic barrel that are easily bonded together; 5) an acrylic cover that fits snugly over the top of the barrel (the top is cut off in order to provide for the cover); and 6) the urethane foam insulation. (See photos.)

Each half of the acrylic barrel weighs 7 lb., 12 oz.—the largest production part ever molded of modified acrylic. When the two halves are cemented together (molded-in tongue-and-groove designs around the rim of each half facilitate assembly), the barrel stands 25 in. high and is 21 in. in diameter at the bulge. The acrylic top cover itself weighs approximately 2 pounds.

All molded parts are sprue gated. It is interesting to note, too, that the manufacturer has been so satisfied with acrylic that he is now planning to switch to the material for molding the splash panel that fits in front of the dispenser (it was formerly made of a polyester-glass laminate).

Contrast this simple assembly with wooden barrels that consist of numerous staves that must be fitted together by expert coopers or with metal dispensers that have more parts to assemble.

In addition, the fibrous glass insulation used in metal dispensers must be installed by hand and requires the use of adhesives to hold it in place—an operation that takes twice as long as that now used for foaming the urethane in place. In the latter operation, equipment is used that automatically mixes and meters the prepolymer and hydroxyl-rich resin, which contains a fluorocarbon blowing agent, and delivers the right amount into each cavity. Each barrel is filled through two openings and it takes only about 37 sec. to dispense sufficient foam to fill the barrel for a complete seal (about 5 lb. of foam are required). Because the foaming action generates heat and pressure that could deform the structure, however, the barrel is reinforced in a frame before it is filled. It remains trussed for 15 min. until the foaming action is **(To page 318)**

ACRYLIC HALVES of barrel are reportedly the largest parts ever molded with this resin. They have tongue-in-groove design, are cemented together at edges after metal ice tank is positioned.

PRE-MIXED urethane foam formulation is metered through hole in top of barrel and foamed in place. Steel frame prevents deformation of barrel from heat and pressure of foaming action.

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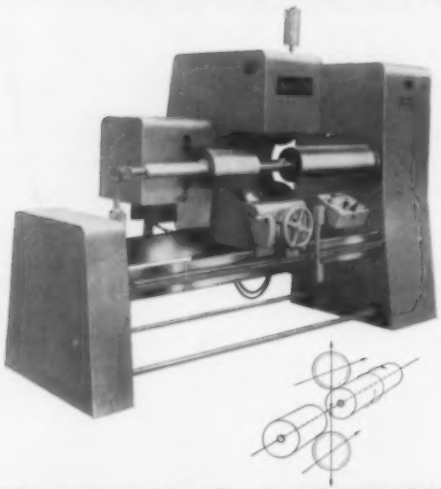

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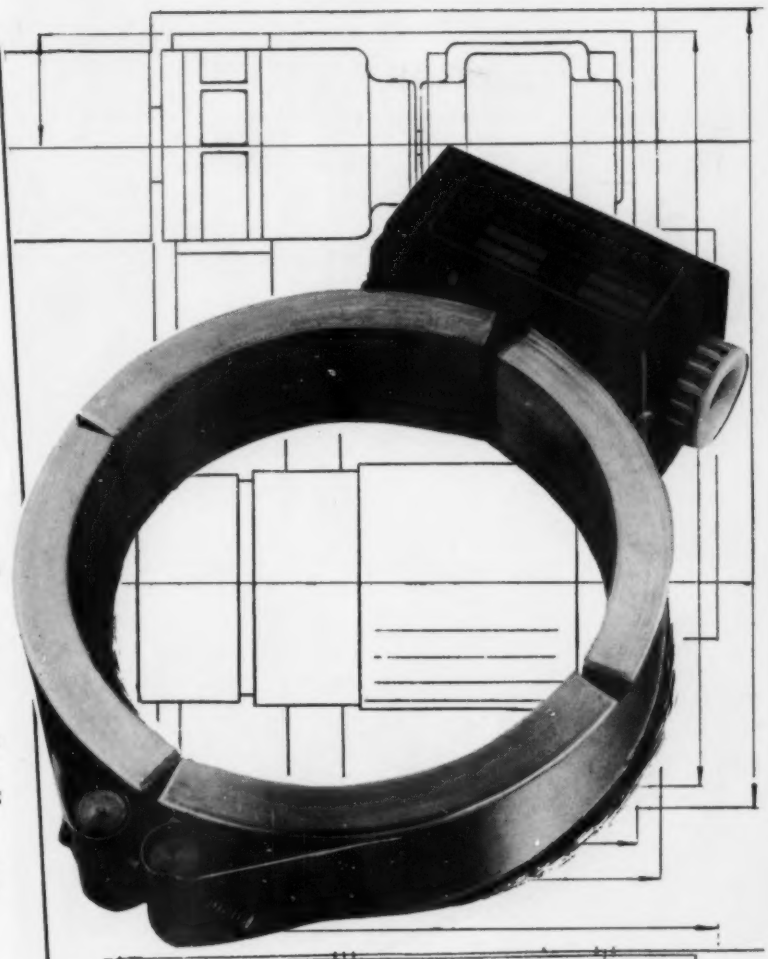

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completed and the foam has been allowed to set.

There are other production economies that derive from the use of plastics in the barrel's construction. Most important is the fact that with the new construction, metal parts of the inner ice chest can be cemented instead of welded —a revolutionary and cost-saving departure from conventional techniques. This is made possible entirely because of the moisture barrier provided by the urethane foam insulation. Other conventional insulating materials would, of course, not make the dispenser secure against leakage.

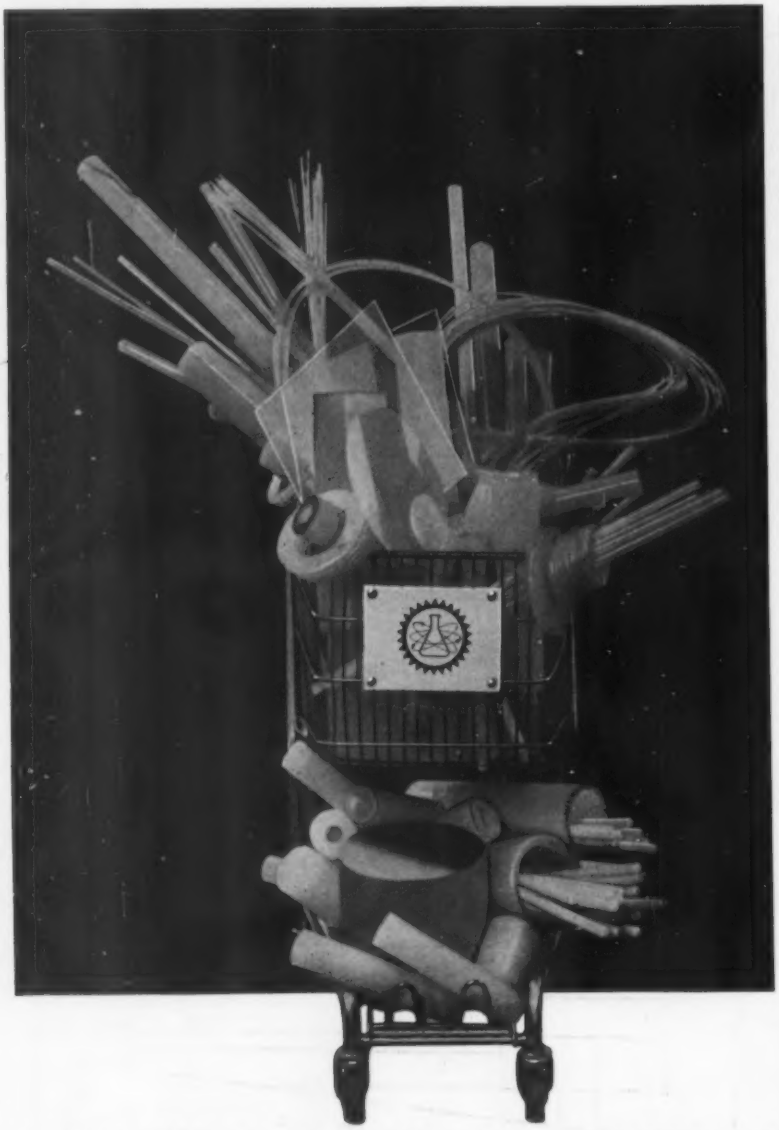
A host of advantages

The plastic construction has resulted in a decided improvement in the dispensing unit. The urethane foam, for example, because it has double the inherent efficiency of conventional thermal insulation, never mats or falls out of place, and does a better job of maintaining proper temperatures of beverages. The foam also provides an excellent moisture barrier, not characteristic in many other insulating materials. And the impact acrylic outer housing neither absorbs moisture nor sweats or drips. The smooth, molded contours of the acrylic housing are easy to wipe clean, will not corrode, and are tough enough to resist chipping—factors which have won for the unit approval of the National Sanitation Foundation.

It has also proved easier and more economical for the manufacturer to work with plastics rather than metal or wood to produce dispensers in a greater variety of colorful, contour designs. And an added bonus: the lighter weight effected through the use of plastics means easier handling and lower shipping charges.

And to complete the cycle, once having discovered plastics, Multiplex looked for other areas of possible use and came up with a molded acetal mixing valve that is more sanitary and more economical than metal valves.

Credits: Lockfoam urethane foam supplied by Nopco Chemical Co., North Arlington, N. J.; Implex impact acrylic by Rohm & Haas Co.; Delrin acetal resin by Du Pont. Acrylic parts are molded by Koller Craft Plastics, Fenton, Mo.—End



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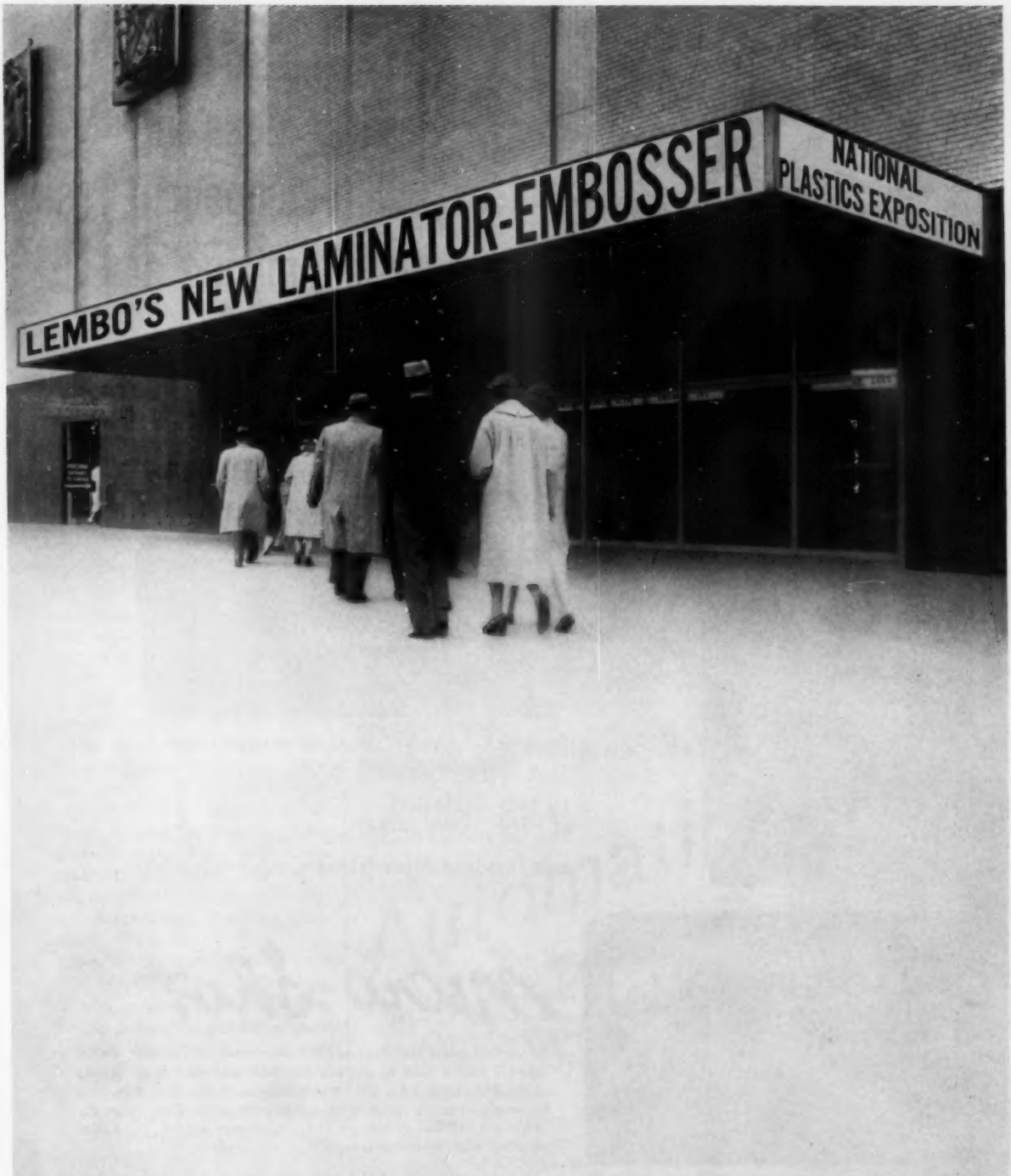

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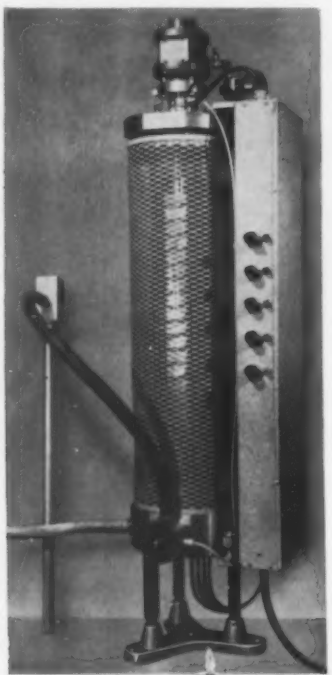

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Garbage disposal

(From page 171)

chosen to provide an additional strength safety factor. For the two less expensive models, the bottom of the central unit is left intact and no acrylic base is used.

The final component in the housing assembly is a top cover also molded of impact styrene. The cover is molded in two sizes—a deep model which is used on the more expensive appliances; and a shallow model, molded in grey, used on the low-end unit in the line. The larger cover weighs 11 oz., the smaller cover, 5 ounces.

By thus combining these various parts, the manufacturer obtains four different versions. Further distinctions in visual identification are obtained by the use of post-decorating techniques. On some of the models, the transparent plastics parts are second-surface painted in gold; on other models, the painting is with silver. An embossed metallized Mylar polyester film trim, applied to a recessed panel molded into the face of the unit shell, is used to dress up three of the models. The fourth has the name hot-stamped onto the recessed panel.

The name plate frame which fits around the recessed panel is also molded of impact styrene. Lugs molded into the back of the frame fit into a series of holes drilled into the panel to facilitate assembly. The same material is used for the small components that seal electrical and plumbing openings in the housing.

Key to the low operating noise level which distinguishes the disposal unit is another unusual plastic part: a collar-like, two-piece insert molded of expandable styrene foam. Mounted in the upper section of the disposer, the collar effectively muffles the noise created by the motor revolving at 1725 r.p.m. as the cutting edges pulverize bones, fruit pits, corn cobs, etc.

The selection of expandable styrene foam for the acoustical liner was based upon its favorable sound-deadening qualities, plus the fact that it could be easily molded to a shape which would fit snugly within the exterior jacket. The liner is molded by the steam expansion process in two mating halves with lugs on one side and cores on the

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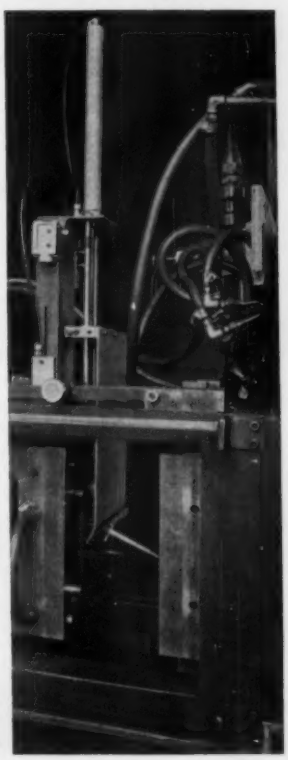

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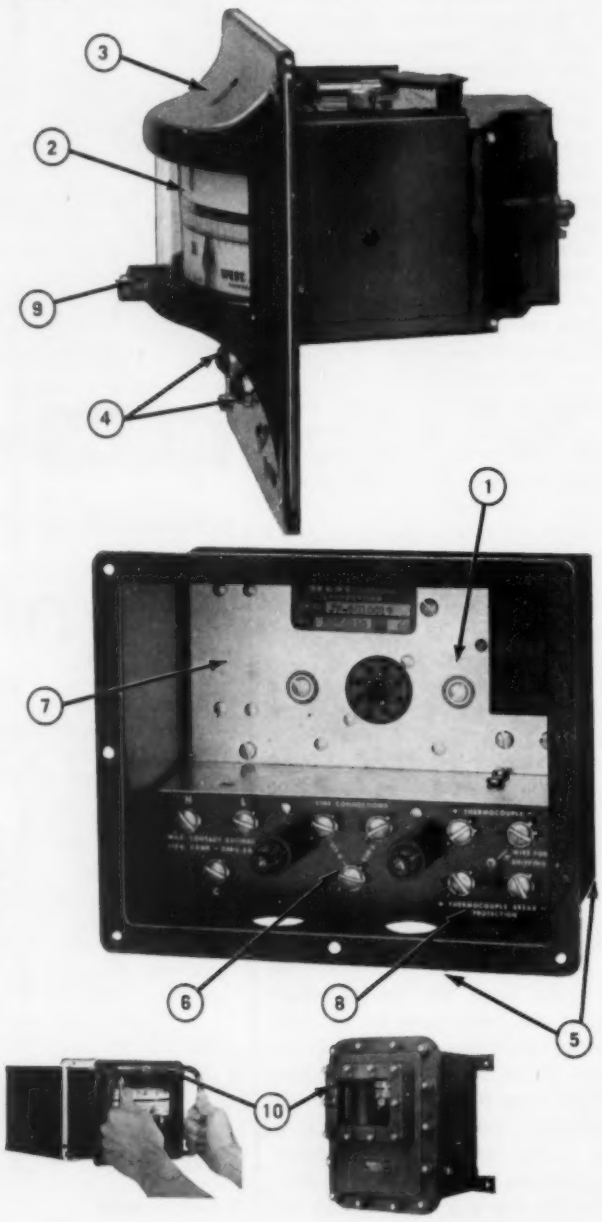

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Heyden's new plants, at Fords and Garfield, New Jersey, have an annual production capacity of 24-million pounds of maleic anhydride, 8-million pounds of white free-flowing technical powder fumaric acid and 12-million pounds of benzoic acid in technical flakes. Heyden offers maleic in the molten state and in 25-gram briquettes which combine the advantages of less dusting and less moisture-absorbing surface.

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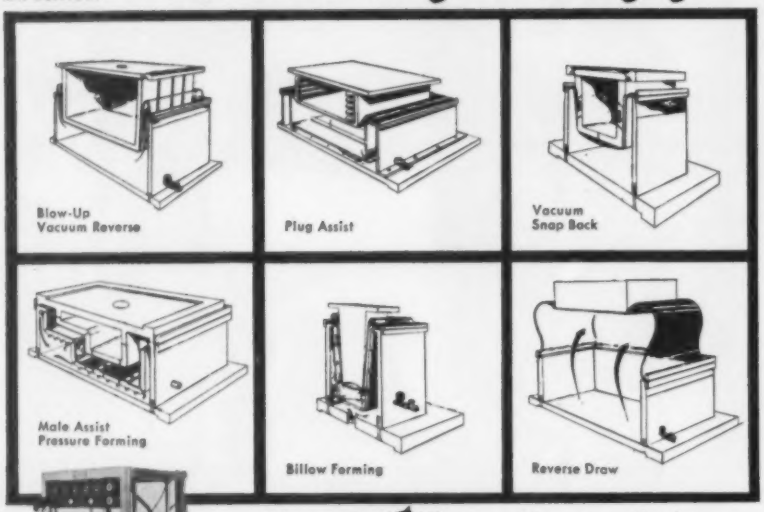

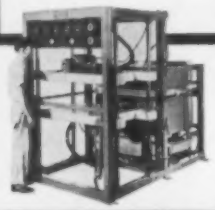

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The parts our method produces range from ⅛" to 1" in diameter and up to 7" in length. They appear in a broad variety of applications in electronics, communication systems, industrial switch gear, radar, television, recording meters and computers.

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Parts mass-produced in quantities of 100,000 to millions. 50,000 and less done on custom basis.

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other to keep them in alignment when brought together.

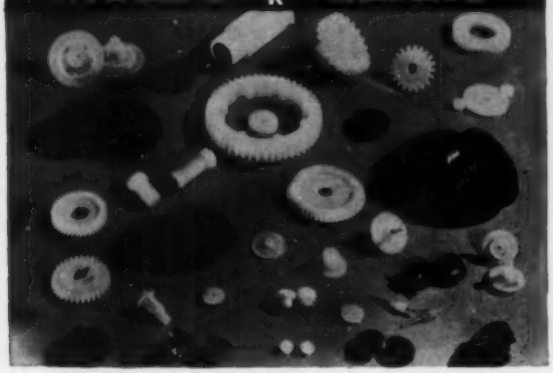
Other interesting functional plastic parts, which are currently being used on various In-Sink-Erator disposal units, are a cam track insert (used on lock-cover models) and a stopper, both molded of acetal resin. The cam track insert, which manipulates the control switch cover, replaces an aluminum casting and offers reduced friction and easier operation for the housewife. Nylon had also been tried for this part but lost out to acetal's lower moisture absorption and increased resistance to staining. The stopper, which replaces a stainless steel part, retains its original white color despite repeated contact with foods and does not scratch up as was the case with the metal unit.

Two types of thermosetting plastics—alkyd and general-purpose phenolic—are used in the patented automatic starting and reversing switch employed in most of the In-Sink-Erator models. Alkyd is used in the base plate, to which electrical contacts are riveted after molding. The superior electrical properties and strength of the material were responsible for its use in this unit. The switch, essentially a disk-like part, is compression molded of phenolic, which offered the desired balance of strength, electrical properties, and economy.

If, for competitive reasons, other manufacturers of disposal units should turn to plastic housings to upgrade the appearance and sales appeal of their products, this type of appliance could in coming years become a sizable new outlet for plastic materials. Although a relative newcomer to the appliance field, units of this type are selling at about 750,000 a year.

Credits: Styling of new In-Sink-Erator models by Reinecke & Associates, Chicago, Ill. Molding of housing components and associated trim parts, G. Felsenthal & Sons Inc., Chicago, using Dow Styron 475 material and Rohm & Haas Plexiglas (for lower section). Foam inner acoustical liner molded of Dow Pelaspan expandable styrene material by Stevens Plastics Products Inc., Hebron, Ill. Alkyd and phenolic components for reversing switch produced by Mayfair Molded Products Corp., Schiller Park, Ill. Acetal cam track insert by Felsenthal; stopper made by Plastic Masters Inc., New Buffalo, Mich., using Du Pont Delrin material.—**End**

MOLDS FOR GEARS



We have wide experience in the design and building of molds for plastic gears. All types of plastics and all types of gears. We can also supply cavities only if desired, made by electroforming, spark machining, hobbing or casting as indicated.

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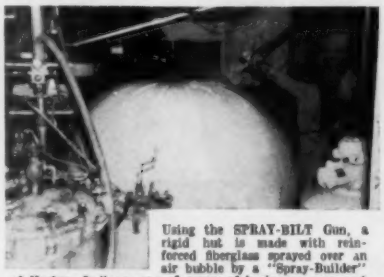

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Example: this Autolite 6-cylinder cap for Chrysler. Why does Electric Autolite specify G-E 12944 Phenolic Molding Compound? Because it offers the best possible combination of performance and molding characteristics for Autolite's line of distributor caps:

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General Electric has tailored this compound specifically for automotive use. It is an example of the care and effort we expend in formulating a compound to meet individual engineering and manufacturing requirements. We have many standard phenolics to meet a wide variety of needs, but we'll be glad to work with you in developing a special formulation to meet *your* specifications. For more information write to: General Electric Company, Section MP-361, Chemical Materials Department, Pittsfield, Mass.

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Princess phone

(From pp. 174-175)

four for the acrylonitrile-butadiene-styrene housing, the other seven for the ABS transmitter and receiver caps for the handsets. Both of these molding operations represent advances in the art of automatic molding.

The Princess housing is molded in a 2-cavity mold at the rate of 85 shots per hour. Total weight of the shot for both of the cavities is 5½ ounces.

The housing is a beautiful example of molding. The piece is essentially a hollow shell with many sharp edges in its contours and with thin-wall sections (that go down in some spots to as low as 0.063 in.); thickness is held to a fair degree of uniformity throughout the piece. Despite these exacting requirements, the piece is produced with no flow lines and no weld lines.

The shell contains, in its interior, several essential supporting members for the telephone mechanism. These members are integrally-molded and must be located with extreme accuracy. Among these are two cylindrical guide-slots which serve as retainers for the on-off buttons. For extra strength, these guide slots are molded with reinforcing ribs whose location also was carefully engineered.

There are also two molded-in brass inserts in the housing—one at each end of the shell—by which the housing is secured to the base of the telephone. In the molding operation, the inserts are loaded, carefully positioned in the mold, and checked—all of this is entirely automatic!

Here is how the handling of the inserts is accomplished:

The inserts are fed from a syntron vibratory bowl, which orients them correctly and "walks" them around the rim into four flexible plastic tubes. Each tube has its own automatic escapement device which releases the inserts one at a time into the loading "tray" mounted at the left of the front of the press. Here the inserts are held in a vertical position.

Originally, air-actuated probes were used to check that all four positions in the loading tray had been "filled" and that the in-

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GENERAL COLOR COMPANY

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serts were right side up. The insert is 0.010 in. larger at the base than at the top—to make it easier for the probes to make this delicate distinction. Any evidence that all four of the inserts were not correctly in place stopped the press automatically. An improved Syntron bowl now makes this step unnecessary.

The loading tray then moves horizontally into the die area, above the lower mold half, and the four inserts drop into their proper place in the mold. With the loading tray still in this position, air-operated plungers come down to seat the inserts on the pins in the mold. Again, if the inserts are not fully seated, the press stops.

The insert loader then is retracted and the molding cycle continues with its operation.

In designing the mold to facilitate automatic molding, a gate-reduction pin was incorporated which is actuated by the mechanism of the press. This device permits rapid and easy filling of the cavity through a large gate, and then, after the cavity has been filled, it punches off the material against the parting surface of the cavity. As a result, only a small flash is left at the gate. This flash is easily removed by the operator who inspects the parts and places them in the trays.

Unscrewing threaded caps

Molding the threaded transmitter and receiver caps which go at each end of the handset—the mouthpiece and the ear-piece you might call them—was also put on an automated basis.

In the past, these caps have been molded on semi-automatic presses, with the pieces unscrewed from the mold cores by hand. This method, however, was too slow for the production rates called for on the job and the entire operation was redesigned for automation. The injection machines were tooled with special molds that are fitted with an automatic unscrewing mechanism which rotates the threaded cores as the molded caps are raised into position on the ejector pins for positive ejection from the mold. The cores are thus withdrawn from inside the caps and the special knockout device on the press insures that no portion of the thread is stripped as the pieces are ejected.

The threaded caps are molded of acrylonitrile-butadiene-styrene, six at a shot, with a 36-sec. press-closed cycle and an 11-sec. press-open cycle.

Thus, the Princess telephone stands out not only as an important volume market for plastics but also as a dynamic testimonial to what the sound use of plastics can economically accomplish.

Credits: AT&T's "Princess" is manufactured by Western Electric Co.; Cycolac T ABS for housing and caps supplied by Marbon Chemical Co.; parts molded at Western Electric's Indianapolis plants on Model 703 injection molding machines supplied by F. J. Stokes Corp.; Delrin acetal for pawl supplied by E. I. du Pont de Nemours & Co., Inc.; Nylatron GS molybdenum disulphide-filled nylon supplied by Polymer Corp. for governor pinion and cam; all of the latter three parts are molded by Gries Reproducer Corp., New Rochelle, N. Y.—**End**

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CONTINUOUS-ROLL OPERATION

KAY ANTI-WRINKLE SLAT EXPANDER

By guarding your processing line against wrinkling, the Kay Slat Expander:

1. Allows faster, more efficient machine operation
2. Reduces losses through rejection
3. Assures tighter, neater rolls
4. Assures higher-quality printing and closer register

Supplied with wooden slats for use at room temp. and aluminum for use in ovens, to 550°.

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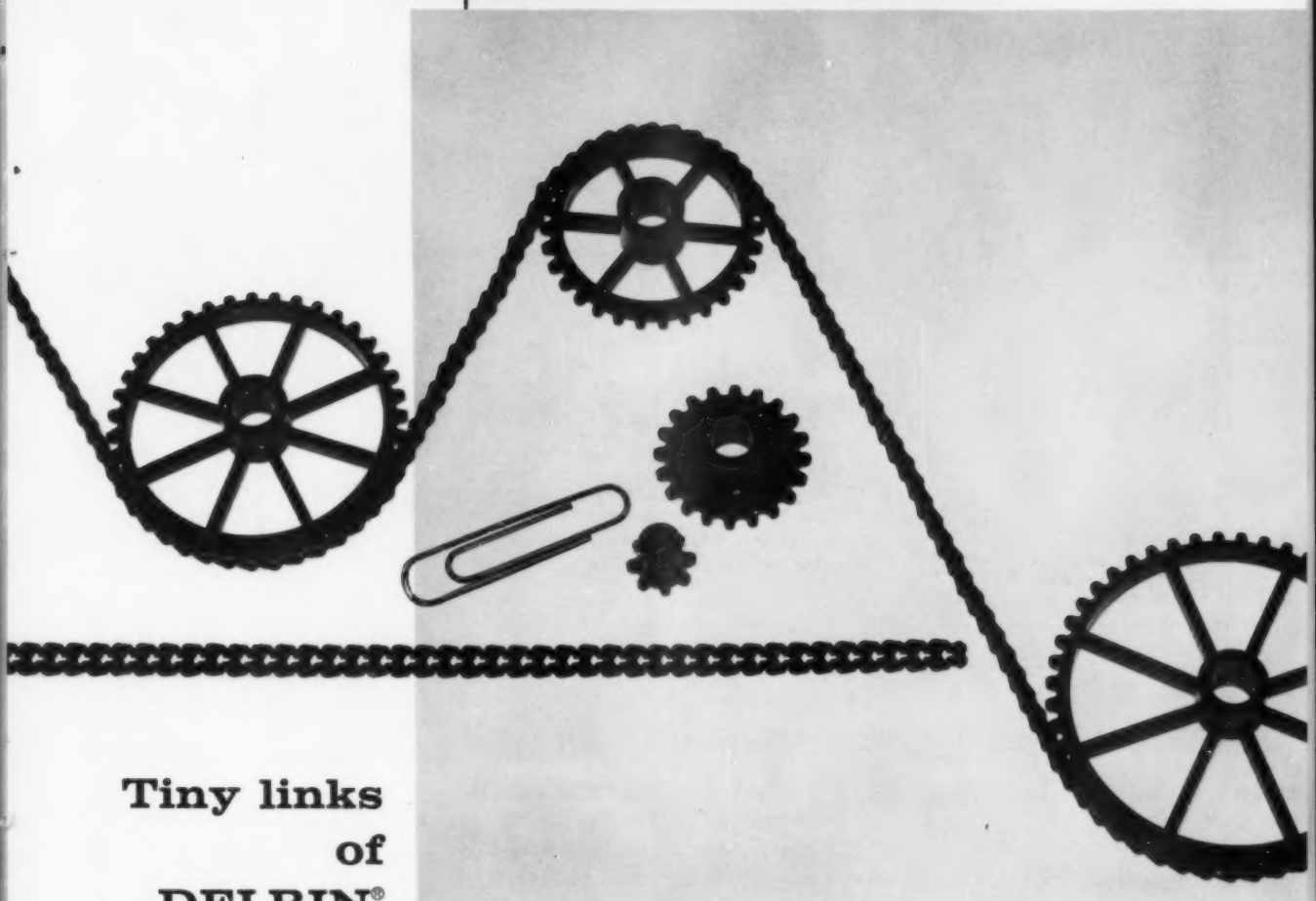
one of Du Pont's versatile engineering materials



Tiny links of DELRIN® make a remarkable miniature chain

These miniature chains and sprockets are significant examples of the way Du Pont DELRIN acetal resin provides superior performance in application areas once reserved for metals. The chain of snap-fit links is made possible by the strength, stiffness and resilience of DELRIN. The need for a master link is, therefore, eliminated, making the chain adjustable in ⅛ inch increments. The chain weighs only 1 oz. per 15 ft.—one-fifth the weight of similar steel chain. It is factory-tested; momentary tension load at 7 lbs.; and running loads to 2 lbs. Manufacturer's service-life tests show a work rate transfer of 0.06 HP for 10 hours . . . 50 foot-tons of work per inch of chain. The chain is solvent-resistant, prelubricated, non-magnetic and non-conductive. These drive components were designed to fill a need in miniature mechanics and instrumentation in a wide variety of high-speed, low-inertia mechanisms.

The manufacturer, Bohannon Industries of Colorado Springs, Col., reports that of the many materials tested, only DELRIN was adaptable to the intricate technology involved in the development of these miniature drive components.

The unique combination of properties offered by DELRIN solve a variety of design problems in areas as diverse as automobile handles and electronic switches. On the reverse side, you will find additional examples of product improvements made possible by this versatile material.

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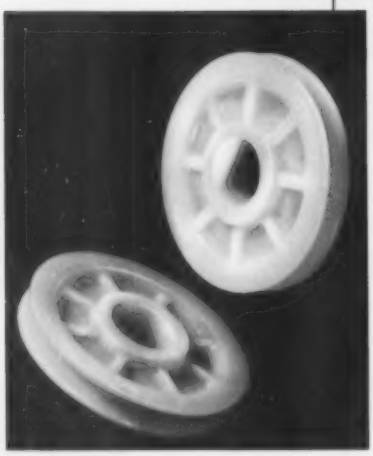

Long-wearing parking-brake cable pulleys of DELRIN® are being used by a leading car manufacturer. The full-radius groove in DELRIN provides natural mating, maximum contact area with the cable . . . eliminates the cable pinching caused by split-type steel pulleys. The new pulleys molded of DELRIN have been tested under severe long-term conditions of high load and temperatures.

Jet injector unit for shallow-well system is molded in three parts of DELRIN and joined by two "one-direction" snap-fits, giving permanent assembly. The new unit outwears bronze by a factor of 2 under sand abrasion . . . molded threads utilize high shear strength of DELRIN acetal resin. (Molded by American Molding Company, San Leandro, for Jacuzzi Bros., Inc., Richmond, California.)

Thumbwheel of this unique multi-deck rotary switch is molded of tough, abrasion-resistant Du Pont DELRIN. A single ¼ inch thumbwheel of DELRIN provides the mechanical and electrical insulating properties needed to handle a combination of rotary switches. (Molded by Par-A-Mount Tool & Mfg. Co., Inc., Chesterton, Indiana, for Chicago Dynamic Industries, Precision Products Division, Chicago, Ill.)

DELRIN® has the strength and toughness to meet rugged mechanical requirements

When a part must function reliably under rugged usage, the strength, stiffness and toughness of DELRIN acetal resin may well provide an economical solution. Parts molded of DELRIN retain a high degree of their mechanical properties under numerous conditions, including broad temperature ranges (–40°F. to 250°F.), humidity, solvents and stress.

Already, many hundreds of designs taking advantage of the unique properties of DELRIN, and of the cost savings made possible by rapid injection molding, have been put into commercial production. Why not investigate further with a view to your own products and problems? Mail the coupon below for more information.

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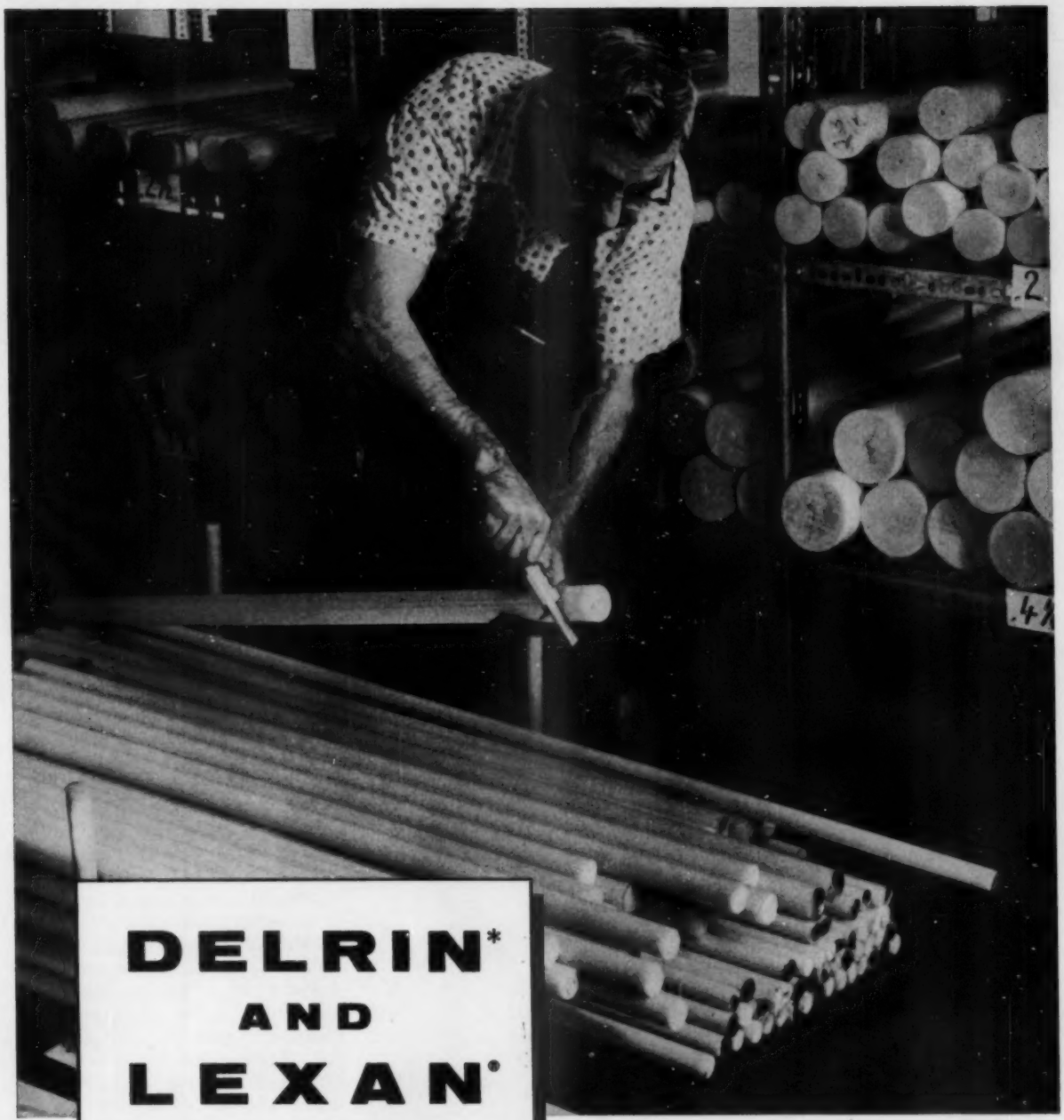

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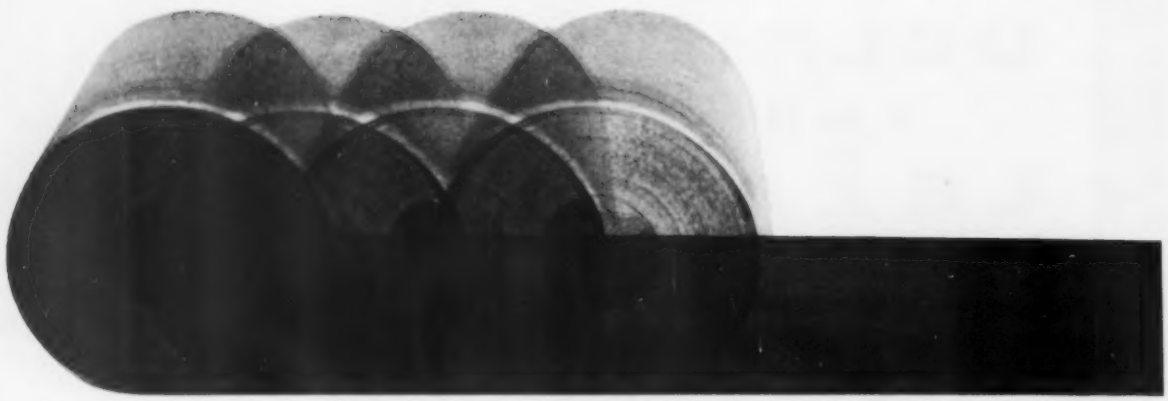


AT BOOTH 719 OF THE 9th NATIONAL PLASTICS EXPOSITION

What's with vinyl? See Cary at the show for an inspiring picture of the 1001 products which can be made better, more saleable, more profitable with the most versatile plastic of all. Hear, too, the inside story of Cary growth—the hottest in the industry—and how benefits will accrue to you... specialized compounding, highest quality materials, total service. The red (vinyl) carpet is out at Booth 719. Stop in.

CARY CHEMICALS, INC. EAST BRUNSWICK, N.J.

Molded frames

(*From pp. 176-177*)

To put the upholstery on an assembly line basis, Prestige went to Bostrom Corp., Milwaukee, Wis., to mold polyether-type urethane seat cushions, back cushioning, and arm padding components. The precision-molded pieces are so designed that they can be slipped easily into place on the one-piece molded chair frame and cemented into position. To complete the unit, a steel base is attached to the bottom of the shell and screw-in legs are attached. The upholstery fabric is then zipped on over the unit—and the chair is ready for market. Truly a mass-production line. Price: $75.

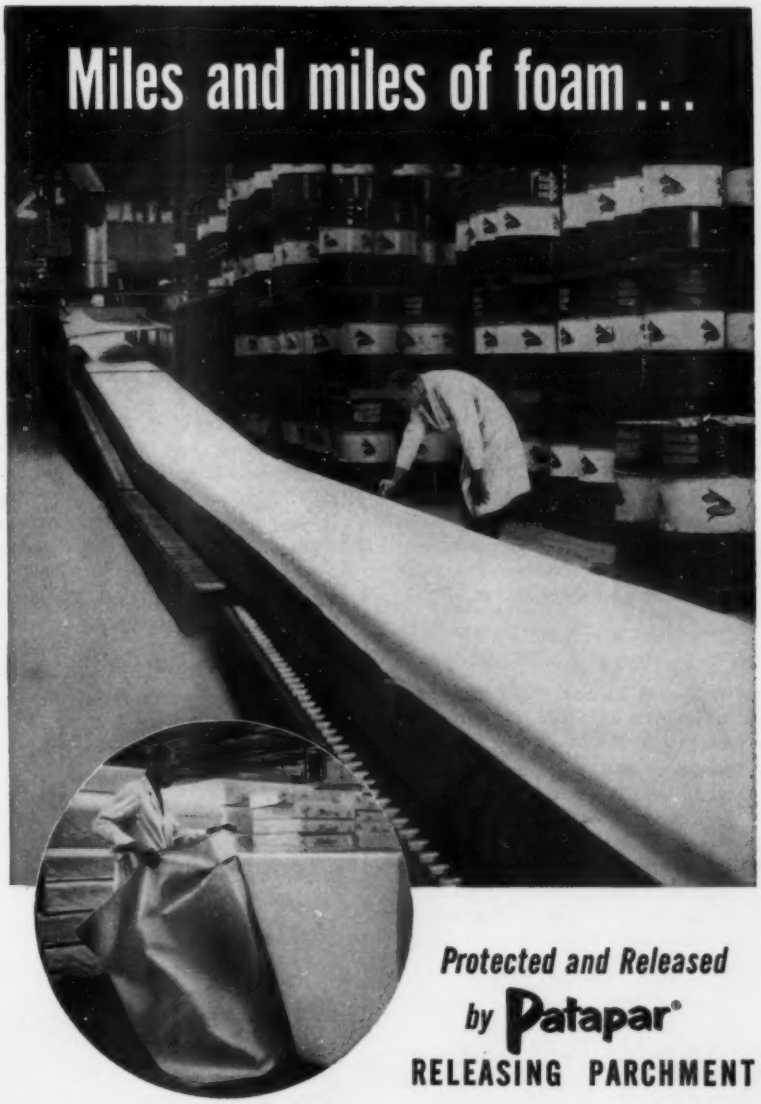
Expandable styrene frames

Another material that has been gunning for the chair frame market is molded expandable styrene beads. Probably the first big breakthrough in the U. S. came in 1959, when Futorian-Stratford Furniture Co., Chicago, introduced a new group of upholstered chairs having frames molded of Koppers Dylite styrene beads by the steam expansion process (MPI, April, 1959, p. 98). These frames, two-thirds lighter and five times stronger than wooden frames, eliminated the costly, time-consuming labor involved in construction of conventional wooden chair frames.

Produced in large hinged molds constructed in Europe, the frames made it possible to design upholstered chairs with contours which would have been extremely difficult and expensive with wood. For finishing, the rigid plastic foam shells were covered with a layer of urethane foam and upholstery fabric was then applied. Legs were secured to a wooden base plate permanently mounted to the bottom of the shells.

More recently, the J. L. Chase Co., Chicago, which is now a division of Schnadig Corp., introduced another group of "Styro-Mold" upholstered chairs having similar type expanded styrene frames and styled by Henry P. Glass & Associates, Chicago industrial design firm. The chairs list at around $89 and upward. The shells were made under a license agreement with Plastomobler A/S of **(To page 339)**

Miles and miles of foam...



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RELEASING PARCHMENT

Three very useful services are rendered by Patapar Releasing Parchment, used as a casting sheet for polyurethane foam at the Nopco Chemical Company, North Arlington, New Jersey.

1. The parchment, formed into a continuous trough, acts as a carrier sheet and is later easily removed from the foam.

2. The parchment serves as wrapping for shipping and handling.

3. The parchment *releases cleanly, quickly, easily* . . . without marring or pitting the foam surface.

Additional advantages are derived from Patapar's high strength, dense, fiber-free surface, and its ability to withstand the exothermic reaction which takes place in the foam.

Perhaps Patapar Releasing Parchment can be an aid in your process. *Send for free sample and information package.*

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Thermolite® ORGANOTIN stabilizers

Used alone for unmatched performance in optical clears, or synergistically to greatly boost the stabilization characteristics of less effective stabilizers.

Thermolite Organotins are the first choice for premium crystal clarity in PVC—and are often the successful last resort when other stabilizers fail under difficult processing conditions.

FOR ULTRA-HIGH TEMPERATURE STABILITY
in the processing of rigids and semi-rigids

Thermolite 35 and Thermolite 36—These new unique stabilizers are the most powerful known for PVC.

Thermolite 31—Processing at 350 F and above is practical with this stabilizer...the standard stabilizer for heat stability in clear or pigmented rigids.

Thermolite 20—Lubrication is built into the molecule of this organotin. For use alone or with Thermolite 31, as lubrication requirements dictate.

FOR VERY-HIGH TEMPERATURE STABILITY

Thermolite 13—Outstanding light stability and excellent heat stability are contributed by an organotin-dienophilic combination in the molecular structure. Particularly suitable for plastisols, rigids, semi-rigids and blending with other Thermolites.

Thermolite 17—Combines the heat stability of the dienophilic Thermolite 13 with the high-lubrication of Thermolite 12. An ideal stabilizer for calendering and extrusions.

Thermolite 12—Outstanding light stabilization and excellent lubrication augment good heat stability. These properties plus ready solubility in plasticizers make it unusually useful for plastisols and organosols.

FOR ALL-PURPOSE ORGANOTIN STABILIZATION

Thermolite 25—Widely used in plastisols because of its excellent heat and light stability and is especially valuable in slush molding where it gives no plate-out problems.

Thermolite 26—A self-lubricating stabilizer with good heat and light stability, especially recommended for calendering vinyl copolymers.

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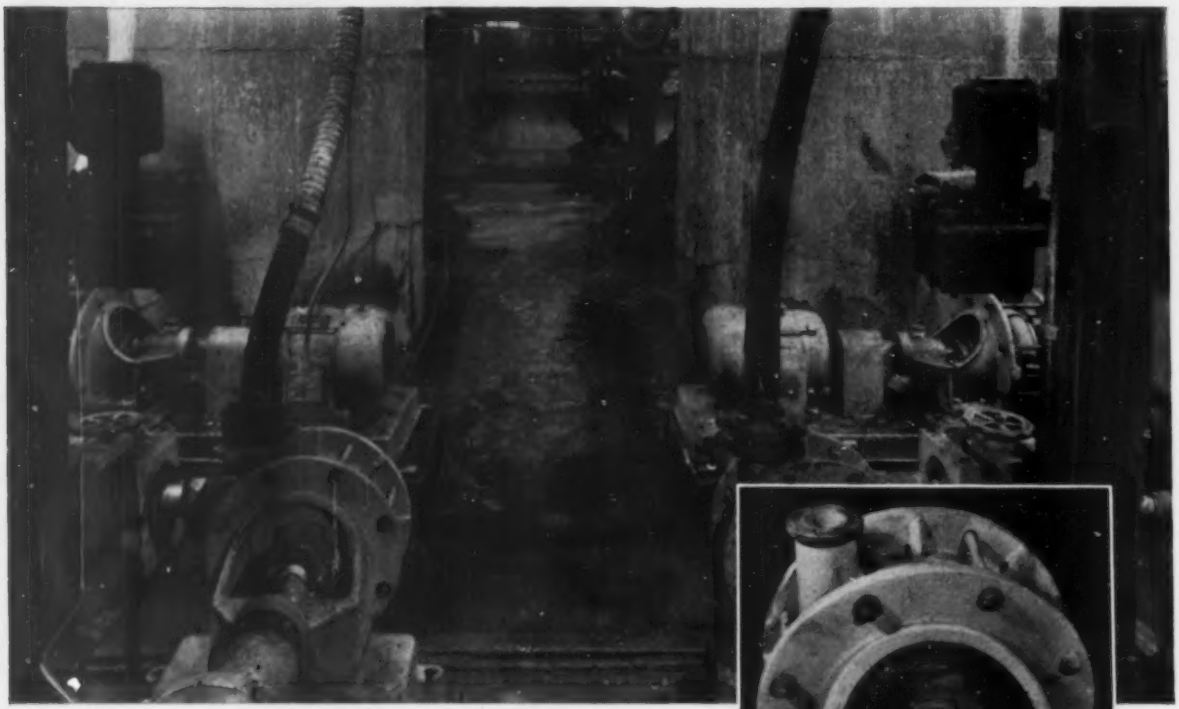

'Fluon' cuts maintenance costs, increases efficiency for Johnson, Matthey and Company Limited

Preformed packing rings made from plaited asbestos rope impregnated with 'Fluon' p.t.f.e. by Crane Packing Limited, are used for gland packings in the centrifugal pumps at Johnson, Matthey and Company Limited. These pumps handle highly corrosive nickel sulphate solutions, containing abrasive materials, up to temperatures of 70°C. These solutions attack all hydrocarbon lubricants, causing conventional gland packing rings to harden.

Johnson, Matthey and Company Limited had to adjust the former gland packing daily and replace packing rings every 200 pump-working hours.

Since changing to asbestos/'Fluon' packing rings there has been a remarkable improvement. At first, gland adjustments were made every two or three days. After a few weeks *no attention was needed at all*. The rings were found to be in *perfect condition after 7,000 hours'* pumping the abrasive-free nickel sulphate solution. When the solution contained abrasives, the life of the rings was slightly shorter, but *many times longer than that of any other packing*.

Trials were run over two six-month periods and these results were obtained:

(1) 67 conventional packing rings were replaced, over six months, in five 2" pumps. In the next six months, only 4 asbestos/'Fluon' rings were replaced.

(2) 168 conventional packings were replaced, again over six months, in five 2½" pumps. In the following six months, only 31 asbestos/'Fluon' ones were replaced.

Initially, these new rings cost more. The extra cost is offset many times over in reduced maintenance costs and greater running efficiency of the pumps.

Pumps which handle highly corrosive nickel sulphate solutions, containing abrasive materials, up to temperatures of 70°C., at Johnson, Matthey and Company Limited, Brimsdown, Middlesex, showing asbestos/'Fluon' gland packings made by Crane Packing Ltd., Slough. The inset shows a close-up of the packing rings in one of the centrifugal pumps.

Plaited asbestos rope impregnated with 'Fluon' p.t.f.e. and made into preformed gland packings by Crane Packing Ltd., Slough.

'FLUON'

'Fluon' is the registered trade mark for the polytetrafluoroethylene manufactured by I.C.I.

Imperial Chemical Industries Limited, Plastics Division: Export Dept., Bessemer Road, Welwyn Garden City, Herts., England

U.S.A. enquiries to: J. B. Henriques Inc., 521 Fifth Avenue, New York 17, N.Y.

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Norway, which pioneered this new construction approach. The cushioning is made up of urethane foam and foam rubber glued together, with upholstery cemented directly to the rubber.

And in the future?

Despite the number of plastics already bidding for the market, it seems logical that the plastics industry will soon see others trying to get a piece of the huge volumes that are involved.

This year, for example, a polypropylene chair will be introduced (without upholstery). But manufacturers are already considering its possibilities in creating a molded shell for upholstered goods. Similarly, high-density polyethylene, which is being used in molded school furniture, is attracting the same kind of attention.

And here's a really new one. (See sketch.) A new group of chairs, designed for Murphy-Miller Furniture Inc. by Henry P. Glass & Associates, will incorporate basic structural shells of molded polyethylene, to be produced by the Thermofusion (Engel) process by Amos Molded Plastics, Edinburg, Ind. Over the plastic shells will be bonded contoured seat and back padding of a suitable cellular plastic material, such as molded urethane or vinyl foam.

Photo, Henry P. Glass & Assocs.

Depending upon finishing details yet to be finalized, the padding may be covered with upholstery or molded with an integral textured skin which would eliminate the need for upholstery.

In all these case studies, the same basic themes run throughout: the use of urethane or vinyl foams for cushioning that can be molded in contoured forms or foamed in place; the use of tough, new plastics for the shell. And the results too are usually the same: lighter weight, lower cost, adaptability to mass production techniques, easier assembly (with no joints to come apart), longer life, and more freedom in styling.

Today's furniture manufacturers and designers now have at their disposal the plastic materials and production techniques to give full rein to the development of entirely new and exciting concepts—involving not only chairs but the full range of seating applications. Just how far the plastic seating revolution will go, and how fast it will move, depends upon the furniture industry's willingness to explore new materials and design treatments. Their attitude will play an important part in building future sales volume.—**End**

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BLOW MOLDING. Illustrated bulletin describes equipment that cuts costs, increases profit margin in production of squeeze bottles, dolls, toy parts, flexible hoses, handles, etc. General description, photographs, other data. The Pneumatic Scale Corp., Ltd. (103-E)

HEATING TAPE. Illustrated bulletin describes heating tape for the sign industry. Used for heating that portion of an acrylic sheet where a bend is desired. General description, prices, other data. Briscoe Mfg. Co. (104-E)

GRANULATORS. Literature describes line of material granulators—including wide throat and heavy duty granulators, drum tumblers, plastic pelletizers. Heater-dryer attachment also covered. General information, features, specifications. Ball & Jewell, Inc. (105-E)

ROTATION MOLDING MACHINERY. 4-page illustrated folder describes line of rotation molding machinery and accessories for vinyls and other thermoplastics. Designed for molding hollow or thin vinyl pieces—using aluminum, bronze, copper or nickel molds. Advantages, features, other data. Brooklyn Blower & Pipe Corp. (106-E)

JOINING GLASS FABRIC. 2-color brochure describes new method of joining pieces of glass fabric without unevenness of sewn splices. Advantages, typical test results, sample included. Hess Goldsmith & Co., Inc. (107-E)

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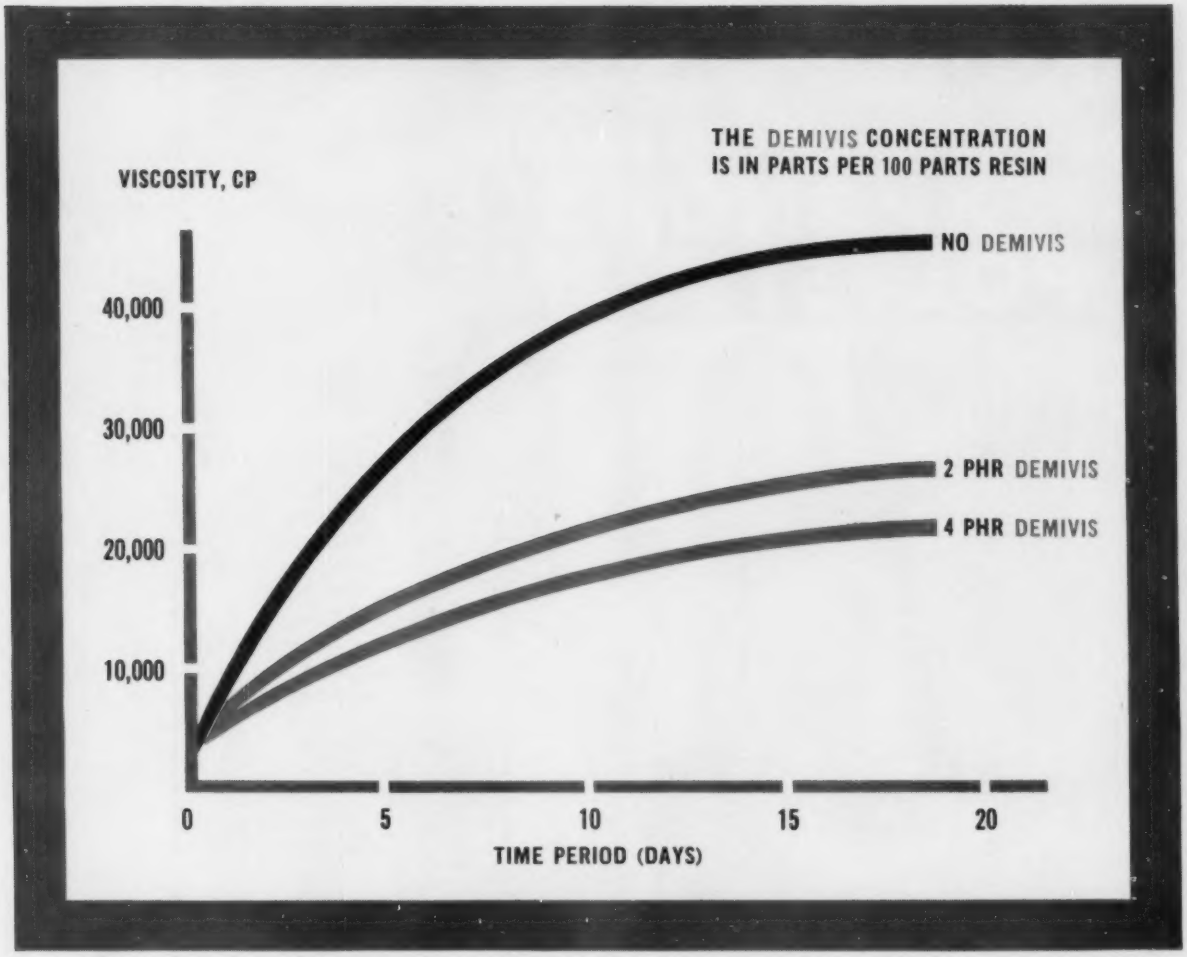

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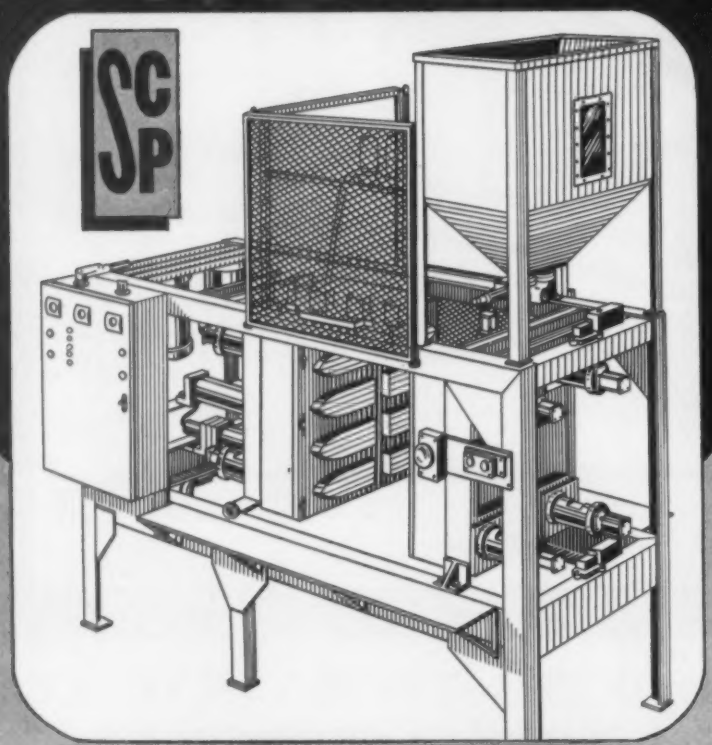

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Corona film treatment

(From pp. 199-206)

slip and anti-block agents require a corresponding increase in treat for printability, as shown in Fig. 13, p. 206. There is a side effect which occurs at this point. Assume a high-slip resin is treated in-line and tested for treat immediately, and, say, 24 hours later. Treat will prove to be better in the first case immediately after treatment. Slip agents bloom to the surface to reduce surface friction, are put in the resin for that reason, and will appear to have "covered up" the treat, or as some people say the treat has "rubbed off."

Actually, no two polyethylenes treat or print the same, unless they should be identical. This, then, forms the basis for future work in which an attempt will be made to correlate printability generally with the type of base resin and types and amounts of additives.

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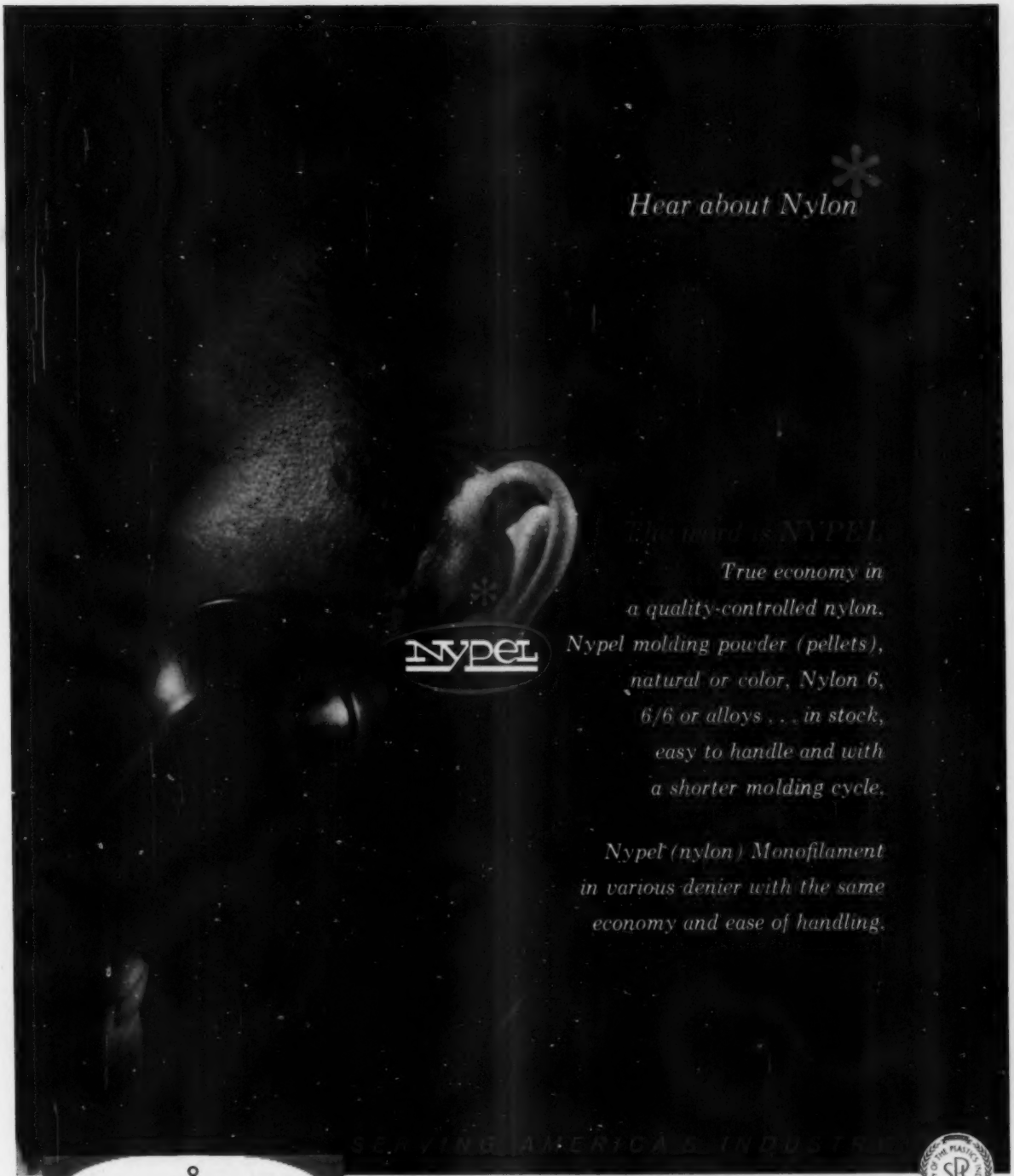
—**End**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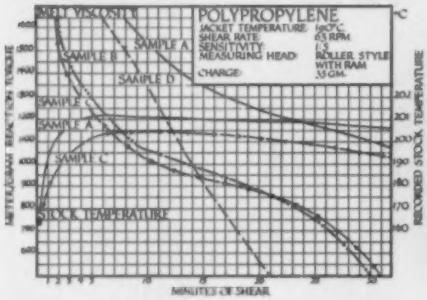

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Dry blend extrusion

(*From pp. 210-220*)

exists in this respect with clear compounds than is the case with filled compounds.

To further show the effect of fine screens and the vacuum hopper, extrusions were conducted with five 325-mesh screens at 44 and 100 r.p.m. using the same basic formulation but varying the plasticizer level from 34 to 74 phr. total. These formulations varied in Shore A hardness from 66 to 96 and in specific gravity from 1.18 to 1.26. The fisheye per gram (0 to 1.50) was insignificant and showed no relation to the plasticizer content.

A resin of moderate fisheye level was chosen to demonstrate the fine-screen method. Table III, p. 219, shows fisheye per gram obtained with five commercial resins extruded at a range of screw speeds using a 20/40/60-mesh screen pack. Rod of Escambia PVC 3250 is essentially fisheye free.

The die used in these studies was a relatively simple one, having highly streamlined design. Those experienced in extrusion with more complicated dies are well aware that imperfections in clear products can result, even with diced compound, from hang-up of extrudate in head and die restriction or from other malfunctioning of extrudate flow. It is our opinion that these imperfections are not fisheye in the sense referred to here. Anyone experiencing imperfections in products extruded with fine screens might look to malfunctioning of extrudate flow for a solution.

For example, in the extrusion of blown film using a dry blend of very low fisheye resin, defects in the blown film were observed. These resemble fisheye which would be expected with a resin high in fisheye. Compounds which have been prepared by Banbury mixing, milling, and dicing produce film having these defects. The use of ten 325-mesh screens produced film of excellent quality, although a few defects were observed. These are believed due to poor extrudate flow beyond the screen pack.

As mentioned above, a 10-hr. extrusion trial with ten 325-mesh screens showed no loss of production rate. The formulation used in this study is well stabilized. No

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thermal breakdown was noted at the site of the screen pack. It has not been determined whether a less stable formulation, such as is used in beverage tubing, would show thermal breakdown on the screens after long-time extrusion.

Further developments

Some problems exist with the vacuum hopper. Perhaps the most serious of these is bridging. Bridging in the hopper can occur with PVC dry blends at vacuum as low as 15 in. depending on the formulation. Highly filled, highly plasticized formulations are most prone to bridging. In a given formulation, bridging seems to be dependent on the technique of dry blending and the nature of the PVC resin. Blends heated to high end temperatures (215 to 220° F.) generally behave better than those heated to low end temperatures (180 to 190° F.). PVC resins with coarse particles of uniform size, which can absorb much plasticizer in hot dry-blending, provide blends which show better flow than resins of fine particle size. Escambia PVC 2000 and 3000 series resins having large particle size (>90% on 80-mesh) are typical.

The use of a hopper agitator has helped in reducing bridging with some of the more difficult formulations. Other methods are under investigation.

Acknowledgments

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Fuel binders

(*From pp. 225-231*)

processed. A recent breakdown of solid rocket cost (13) indicates that total labor is as follows:

Hardware preparation and assembly	25%
Disassembly and trim	20%
Quality control and firing	20%
Loading	12.5%
Shipping	12.5%
Manufacture of propellant	10%

The cost of the chemicals is 0.5 to 5% of the total unit cost.

Essentially, processing of composite propellants made with plastic fuel-binders follows techniques used in casting or extruding filled resins (14). However, rigid safety rules must be enforced because of the potential hazard of the material. By and large, batch techniques are used, but continuous mixing has been employed. Time (min.) for mixing depends on the degree of dispersion desired and is limited by such factors as pot life. Pressure or vacuum casting is used. Casting may be done via a deaerated mix or into an evacuated casting vessel or lined rocket motor. A mandrel is used to give the necessary internal geometry. Casting is a low-cost process, and is adaptable to a variety of grain configurations. Extrusion is expensive, but is more economical for large runs of the same grain configuration.

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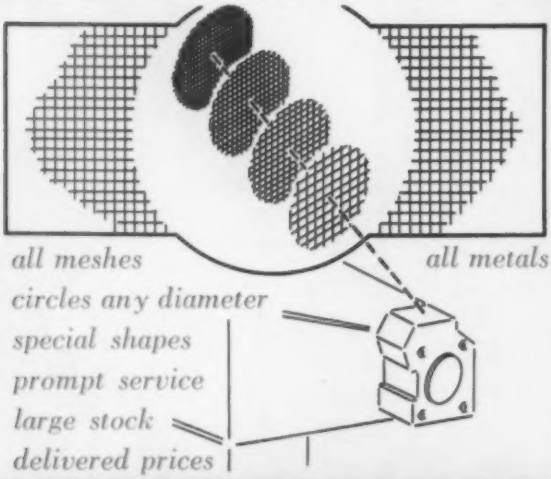

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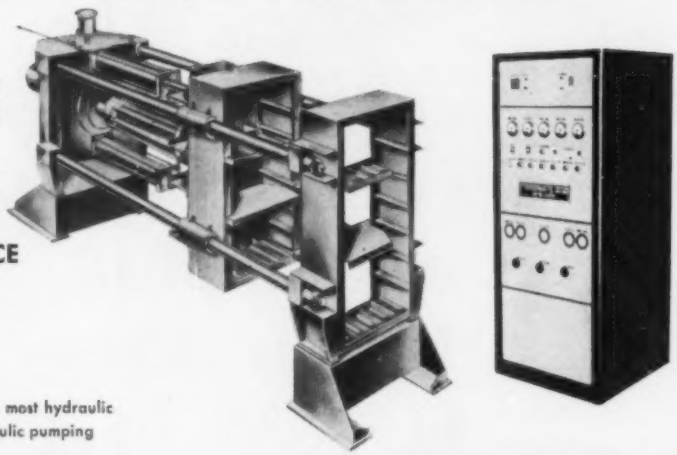

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Adsorption

(From pp. 241-245)

Frisch and Simha from a statistical mechanical treatment of polymer adsorption (18). They are based on a Gaussian chain adsorbed at several sites with loops penetrating into the solution. It is of interest to examine what their equation predicts. This has been done, in part, by Simha (18). A steep initial rise in the isotherm is predicted for low concentrations. Most large polymers show this initial rise. The isotherms for polyesters were steep at very dilute concentrations and gradually became less steep with increasing concentration. The large polymers reached a plateau region at much lower concentrations than the polyester samples did. As complete monolayer coverage is approached, the slope of the isotherm predicts an extended flat region of apparent saturation. This has been observed in both good and poor solvents (1a, 2). The dependence of adsorption on time is positive and proportional to θ, the fraction of surface covered by polymer segments, as $\theta \rightarrow 0$, decreasing with increasing θ. Very rapid adsorption of the polyesters was observed. It is reasonable that as the surface becomes more saturated, more time must be taken for the polymer to locate available sites.

The dependence of adsorption on temperature involves a competition between the usually negative terms, *i.e.*, the energy required to evaporate an adsorbed segment and the "free volume" per molecule of solid polymer, and a positive term, the change in the number of adsorbed segments with temperature. If solvent is adsorbed, there is an additional positive contribution. There can exist, therefore, a positive temperature coefficient of polymer adsorption arising from desorption of solvent. In all cases it was assumed that, in general, solvent was adsorbed initially, then desorbed and replaced by polymer. It is possible that the polyesters had a true positive temperature coefficient on silica, as shown by adsorption from chloroform, which was hidden by the solvent effects of toluene. In view of the competition of the negative and positive terms, it appears that the positive and negative temperature coefficients reported are valid and that the sign depends on the particular system. The equations also predict that more polymer will be adsorbed from a poor solvent than a good one.

A number of attempts have been made to apply the Simha-Frisch-Eirich and Frisch-Simha (18) equations to experimental results. In all cases several simplifying assumptions and approximations were required. Kraus and Dugone (23) attempted to apply an early version of this equation to the adsorption of elastomers on carbon black. Their system was not completely reversible, and the use of a porous adsorbent necessitated some assumptions regarding the area available to the polymer. The number of segments adsorbed per polymer molecule was calculated to be between 1.4 and 13, depending on the system. Koral (2) obtained a value of about 5 for the number of adsorbed segments of poly(vinyl acetate) on iron powder, which he believed to be low. Frisch, Hellman, and Lundberg **(To page 356)**

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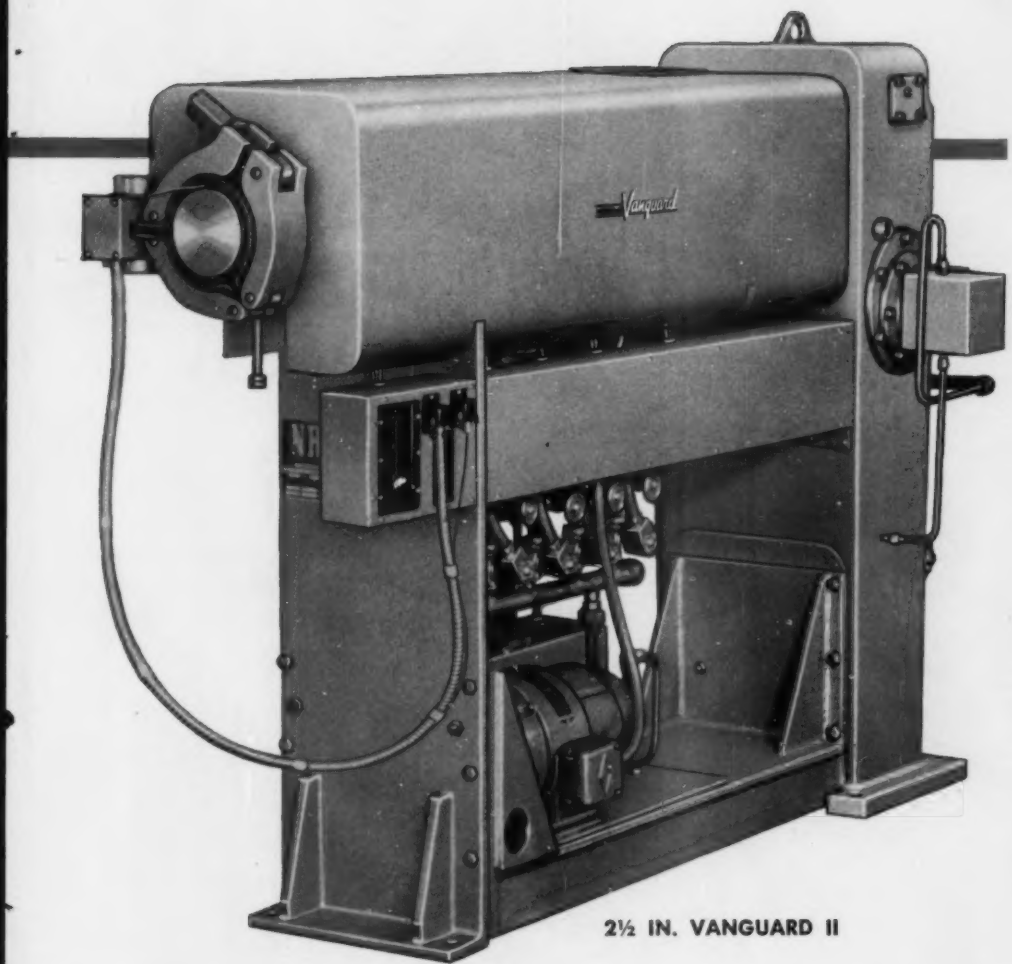

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(11) attempted to fit their polystyrene-carbon adsorption data to an idealized form of the Frisch-Simha equation (18):

$$\theta = \nu N'/N_s = \nu W/N_s \overline{M}_n \quad \text{Eq. 4}$$

where ν is the average number of segments adsorbed per chain, N', $\overline{M}_n$, and W are the number, number-average molecular weight, and weight of adsorbed polymer molecules, respectively, and N_s is the total number of adsorption sites. This yields:

$$\frac{\theta}{\nu (1-\theta)^{\nu}} = K_c \quad \text{Eq. 5}$$

where c is the polymer concentration in solution and K is the effective adsorption isotherm constant. For the case where $\nu = 1$, the equation can be written in the form:

$$c/W = (1/K N_s \overline{M}_n) + (c/N_s \overline{M}_n) \quad \text{Eq. 6}$$

which is the Langmuir isotherm. K is now the effective Langmuir isotherm constant. Frisch *et al.* compared their experimental results with Eq. 5 and 6, using in Eq. 5 a value of 50 for ν, the number of anchor segments per polymer molecule. Although the use of Equation 6 ($\nu = 1$) yields a plot that fitted the data, the use of Equation 5 ($\nu = 50$) gave a more reasonable area per adsorption site, 900 A^2.

Adsorption isotherms differing from those of Simha, Frisch, and Eirich (18) have recently been proposed by Gilliland and Gutoff (19). Equations which were derived for the case were 1) all segments of the adsorbed molecule are on the surface (two-dimensional) and 2) some segments are not adsorbed (three-dimensional). They concluded that preferential adsorption of either the high or low molecular weight species is possible. Preferential adsorption of the high molecular weight species is favored by high heats of adsorption. Their equations further indicate that the fraction of the surface covered is proportional to the weight of polymer adsorbed. The amount adsorbed at low concentrations is proportional to solution concentration and at high concentrations reaches an asymptotic value. These studies also predict that in the vicinity of the theta temperature adsorption will decrease with temperature.

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[a]Refs. 1 to 18 appeared in Part I.

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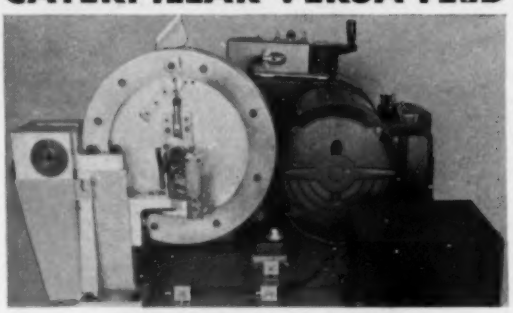

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News and interpretations of the news

By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 35*)

May 1961

Rigid urethane foam insulation

A new line of rigid polyether-type urethane foam sheets, designed to meet the demand for space-saving insulation, has recently been introduced by the Barrett Division of Allied Chemical Corp.

According to G. Peter Oldham, vice-president for marketing, "the unique insulating efficiency of this closed-cell urethane makes it ideal for perimeters, freezers, cold-storage plants, electrically-heated and air-conditioned buildings, ducts, walls, pipes, equipment, and other heat and cold retaining applications which demand light weight, space-saving material."

In addition to the standard urethane foam, Barrett has introduced a flame-retardant-coated version designed to minimize fire hazards during construction operations.

The urethane insulation is available in panels of various thicknesses up to 11 inches. Blocks of foam suitable for use as pipe insulation and lagging also are available.

Some of the new insulation's properties are listed below:

It is said to offer at least 50% greater thermal efficiency than other types of insulation of equal thicknesses, thus permitting the use of thinner sections which afford equal insulation value.

It can be applied directly with hot asphalt and many other adhesives.

It weighs approximately 2 lb./cu. ft., or less than 3 oz. per board foot.

It is impervious to deterioration from rot and fungi and does not attract insects and vermin.

It does not absorb water and it likewise maintains consistently low vapor permeability.

Mr. Oldham predicted that this new, lightweight plastic foam insulator will fill an urgent need within the construction industry for a more versatile, high-efficiency insulating material than is available to builders.

Faster molding nylons

Development of two new nylon 6 resins, which can increase production rates of injection molded parts, has been announced by Spencer Chemical Co., Kansas City, Mo. The new resins, Nylon 401A and Nylon 605A, have been field tested for several months, and in many cases their use has reduced cycle times on injection molding machines up to 40% in applications ranging from miniature parts produced in multiple-cavity molds to single-cavity molds taking up to 3 lb. per shot.

According to Spencer, the new materials are said to have increased flow properties and require lower ram pressures and heater settings. These processing characteristics, in addition to reducing cycle time, enable the reduction of "sinks" and "voids" encountered in molding thick-section parts, and quick and adequate filling of intricate and thin-walled molds.

Among the examples cited to show the increased productivity obtained with the two new nylons are: a switch part which had been produced in a 26-sec. cycle was produced in 16 sec. with Nylon 605A; a speedometer gear which had been produced in a 40-sec. cycle was produced in 24 sec. with Nylon 605A; a comb mold which had required 58-sec. cycles required only 45 sec. with Nylon 401A; a blower rotor which had previously required a 51-sec. cycle needed only 30 sec. with Nylon 401A.

In addition, both materials were successfully used in a chair seat mold requiring two "shots" and a total "shot" weight of 3¾ pounds. Other materials required more heat, some to the point of degradation, and exhibited excessive sinks and voids, according to Spencer Chemical Co.

Vinyl coating for metals

A recently introduced strippable vinyl coating eliminates marring and scratching of polished, embossed, or coated metals during fabrication, storage, and shipping. Called Strip-Gard by its developers, Stoner-Mudge Co., Pittsburgh, Pa., the clear vinyl coating provides all the protection necessary to preserve the surface of polished or prefinished sheet metal used for such products as building panels, automotive trim, and kitchen ware.

Strip-Gard is an organosol based on Geon vinyl manufactured by B. F. Goodrich Chemical Co. Since the Geon coating is extremely flexible, metal surfaces protected by it can be corrugated, embossed, roll formed, or drawn, in many cases without lubrication. Although it is not intended for permanent protection against weathering, it will not discolor or become brittle even when exposed outdoors for periods up to six months.

A typical use of this material at E. G. Smith Co., Pittsburgh, is for the protection of epoxy painted siding and roof deck. Metal strips destined for use in these products are coated with Strip-Gard immediately after painting. There is no attack on the thermoset epoxy by the "wet" Strip-Gard, and the fused protective film can be easily removed when desired. The painted surface gets completion protection through either roll forming or barrel corrugating.

Vinyl copolymer line added

Thompson Chemical Co., Pawtucket, R. I., has added a series of vinyl copolymers (Trulon 750 and Trulon 760) to its expanding line of products. This move complements the company's recent introduction of Trulon 630, a low-molecular-weight polyvinyl chloride with high plasticizer absorption characteristics. Trulon 630 is useful in the manufacture of molding compounds for electrical connectors and similar applications, as well as a processing aid for use in the calendering industry.

Water-soluble film

A new water-soluble film, made from polyethylene oxide resin, is now available in limited quantities from the New Products Planning Dept. of Visking Co., Div. of Union Carbide Corp., Chicago, Ill. Called Hylox, the new film has the following claimed properties: excellent solubility, good low-temperature performance, and good sealing, printability, and shelf-life. Other characteristics claimed for the new film are that it can be easily heat-sealed at about 150° F.; it will not dehydrate or embrittle; and since the film is permeable to organic vapors, it would be suitable as a package for items where odor has an appeal. The film functions primarily as a container for the packaging of additives in premeasured quantities.

According to the company, Hylox film will soften at water temperatures from about 35 to 175° F., without a trace of the **(To page 360)**

*Reg. U.S. Pat. Off.

News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

Now you can "contact bond" polyethylene foam to itself, wood, metal, concrete...

8 typical Bondmaster® adhesives for flexible foams:

FOR POLYETHYLENE FOAMS

BONDMASTER G590: High strength "contact" type adhesive for **foamed** polyethylene to itself, to wood, metal, hardboard, etc. Good heat-resistance; excellent resistance to salt water and high humidity conditions.

BONDMASTER G523: "Longer-open-time" variation of BONDMASTER G590.

FOR CLOSED-CELL VINYL FOAMS

BONDMASTER G483-20: Widely specified for athletic protective equipment, gymnasium mats, etc, withstands standard vinyl protective coatings.

BONDMASTER R379-20: Highest strength, salt water, humidity and solvent resistance; withstands hot vinyl marine coating dips.

FOR POLYURETHANE & RUBBER LATEX FOAMS

BONDMASTER R275: Outstanding economy coupled with softest, dimple-free seams. For urethane and rubber latex foams to themselves or to each other.

BONDMASTER R322: R275 type in a non-flammable solvent. Soft seam, quick-grab, dries tack-free.

BONDMASTER R828: Highest strength bonds of polyurethane and vinyl foams to wood, metal, or other rigid surfaces, and to many fabrics.

BONDMASTER R203: Extremely fast drying for instantaneous bonding of fabric reinforcing tapes to polyurethane or latex foam cushions, etc.

WRITE FOR DETAILED TECHNICAL DATA

R&A SINCE 1913

RUBBER & ASBESTOS CORPORATION

243 BELLEVILLE AVENUE
BLOOMFIELD, NEW JERSEY

That photo, above, shows a typical bonded mitred joint at the corner of a trampoline protective bumper. Not only are the polyethylene foam slabs bonded to each other, but the entire bumper is firmly anchored to a concrete apron . . . with the very same adhesive.

The completed bonds are subjected to all sorts of rigorous punishment in use (abrasion, impact, peel forces, etc.). In addition, since these are field installations, the assembly must withstand the broadest possible span of outdoor weathering conditions (sunlight, rain, sleet, snow, salt water, heat, cold, etc.).

Either of two high-strength, water-resistant R&A "contact bond" adhesives now make it possible for you to achieve bonds of foam-tearing strength between this expanded plastic and just about any other material.

BONDMASTER G590 is a fast-drying "contact" adhesive which can be applied by brush, trowel, paint roller, flow gun, or spray gun. At room temperature, adhesive-coated components can be mated in about 20 to 30 minutes after application. Assembly consists simply of aligning coated parts carefully before mating and then using firm hand pressure to insure intimate contact over the entire area being bonded. Bonds of foam-tearing strength develop instantly.

BONDMASTER G523-20 is a longer "open time" variation of this product for use where an extended delay between coating and assembly is desired.

WRITE FOR FREE DATA

Write for Special Application Report on "Bonding Foamed Polyethylene", detailing application techniques for bonding this new foam with these formulations. If you will describe your problem in detail, we'll be glad to send a no-charge sample for evaluation.

THE PLASTISCOPE

(*From page 358*)

film remaining within 5 min. of immersion. In 2-mil thickness, it will release the entire contents of a package into water in about 8 to 10 seconds. Some suggested applications include packaging of dry detergents, bleaches, and a number of other similar household items.

Another possibility is as a container for chemical and industrial powders that need to be added in exact amounts with controlled sequence and solubility. The handling of toxic items is another possible application.

At present, Hylox water-soluble film is available in thicknesses from 1½ to 10 mils. It comes on rolls in widths up to 20 in. on sheet stock only.

New coating resins

A new synthetic resin, named Pentalyn 255, is now commercially available from Hercules Powder Co.'s Synthetics Dept. The resin is soluble in alcohol and in aqueous ammonia, exhibits a broad range of compatibilities; and, in addition, it has a high softening point and is hard and friable at room temperature. Its unusual characteristics suggest immediate applications in flexographic and glycol-soluble inks, overprint lacquers, polymer-type emulsions, and in a wide range of similar applications.

One of its outstanding advantages is that it exhibits broad compatibility with polystyrene, acrylic, PVC, polyethylene, and copolymer emulsions, and with the other ingredients used in the various types of compositions made from such emulsions.

Polystyrene foam for packing

Limited production of expanded polystyrene for protective inner packing of fragile products has been started by Container Corp. of America, Chicago, Ill. The polystyrene will be processed by the Mengel Div., Louisville, Ky., the company's corrugated shipping container plant, where a molded-foam department has been established.

Polyolefin adhesives

A 100% solids hot-melt pressure-sensitive adhesive applied from the molten state at 250° F. is available for polyolefins from Flexabar Corp., Rockleigh, N. J. The advantage of hot melt is a quick setting time and elimination of a flammable solvent. Such adhesives are suggested for small unit assemblies. This formulation is also available in 50% hexane solution and can be easily brushed on the surfaces to be adhered.

The company also produces cement adhesives with added rigidity for use where there is less stress and the need for a stiffer bond is imperative. These are also available in a hot melt and 50% hexane solution. The above adhesives can be applied to untreated polyolefin surfaces.

New PVC plasticizer

Experimental and commercial quantities of a new improved stabilizing plasticizer for polyvinyl chloride and other vinyl halide resins are now available from Swift & Co., Technical Products Dept., Hammond, Ind. Designated as Epoxol 9-5, the material is an epoxidized oil with a minimum of 9% oxirane oxygen and an average of over five epoxide groups per molecule.

The oxirane oxygen content of 9% minimum closely approaches the theoretical limit for this type of material and should provide the ultimate in resin compatibility and heat stability. With materials having oxirane oxygen in the 6 to 7% range, an increase in the concentration of epoxidized oil plasticizer to achieve the desired heat stability often led to spewing. When the concentration was reduced sufficiently to end the spewing, heat stability was reduced. Tests indicate that Epoxol 9-5 will assist in solving this conflict by permitting the use of plasticizer concentrations that were previously impractical.

Swift & Co. has recently started construction of a major addition to its epoxidation plant at Hammond. The new unit, which is located in an area adjacent to existing facilities for propane processing and esterification, will add 8 million lb. annually to Swift's epoxidation capacity.

Anti-static fluid

A new chemical fluid to prevent build-up of static charges on plastic-faced instruments has been introduced by Daystrom Inc., Weston Instruments Div., Newark, N.J. The material is called Statnul and provides a thin transparent coating which drains off static electricity.

At present, most anti-static agents require a relatively high percentage of atmospheric moisture to provide a good conductor for static charges. However, parts treated with the new fluid have satisfactorily retained their anti-static properties even under extreme dry conditions, according to the company. Statnul reportedly has remained effective in sustained atmospheres of 2% relative humidity.

Adhesive coating is anti-static

A new synthetic rubber-base adhesive, said to provide excellent adhesion to some plastics, metals, glass, and most porous materials for the conducting away of static charges, has been announced by Schwartz Chemical Co. Inc., Long Island City, N. Y. Resistance of the black adhesive coating, designated Rez-N-Glue 159, to oil, gasoline, water, heat, and cold make it suitable for use as a protective coating against rust and corrosion. Coatings can be applied by brushing. Each coat produces approximately 2-mil thickness of static-conducting surface.

Corrosion-resistant coatings result from the application of two or more brush coats with allowance of about 1-hr. drying time between coats. One gallon will provide one-coat cover for approximately 200 sq. feet.

Paper base-phenolic tubing

New high-strength paper base-phenolic tubing in internal diameters of ⅛ to 48 in., lengths up to 80 in. and in wall thicknesses from 1/32 to 1 in., is now available from the Micarta Division, Westinghouse Electric Corp., Hampton, S. C. The tubing, Grade HY 488, was developed to withstand exceptional compressive and burst forces applied radially and is expected to find use in fuse tubes, rocket flare tubes, textile bobbins, and similar applications.

Axial flexural strength is 19,650 p.s.i., axial tensile strength is 12,025 p.s.i., and ultimate fiber tensile strength is 33,750 p.s.i.

New low-cost stabilizer

Claimed to cut stabilizer costs more than 50%, a new stabilizer offered by Allied Asphalt & Mineral Corp., Great Neck, N. Y., and designated Y-3, can be used in both filled and unfilled formulations to prevent heat decomposition during processing or service, according to the producer.

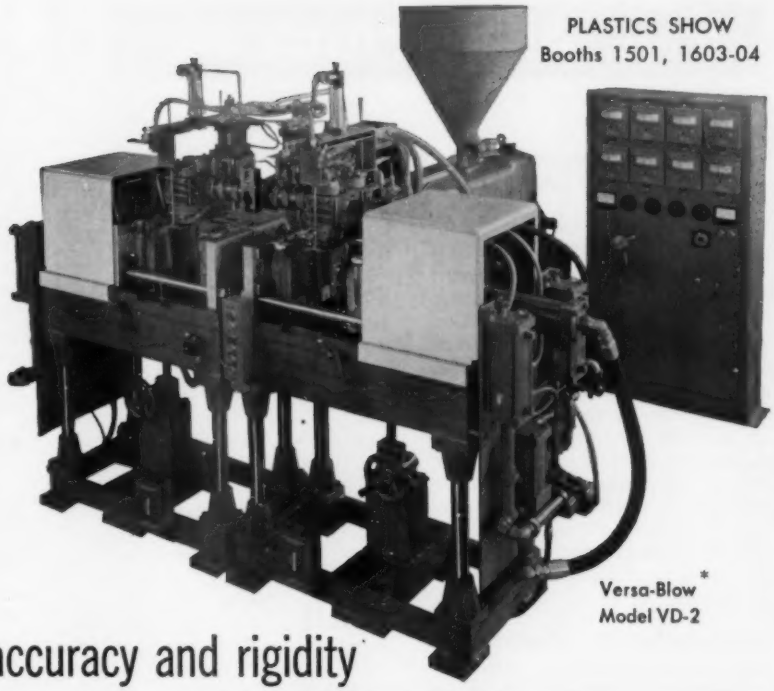
Stabilizer Y-3 is said to have a multi-purpose function; it serves as an aid in wetting fillers and as a mold or calender lubricant in extrusion or calendering operations, as well as a heat and light stabilizer. Initial testing shows little restriction on the use of the new stabilizer, essentially a barium calcium soap in composition, the company claims. Its first major use has been in vinyl-asbestos floor tile.

Low viscosity plasticizers

A new line of low viscosity monomeric plasticizers has been announced by Archer-Daniels-Midland Co., Min-

PRODUCTO BLOW MOLDING MACHINES

PLASTICS SHOW
Booths 1501, 1603-04



Versa-Blow* Model VD-2

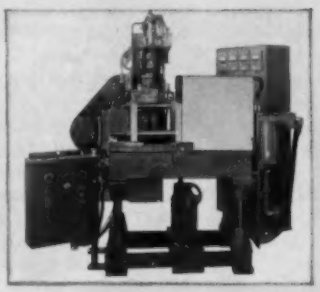
feature machine tool accuracy and rigidity

Precision and dependability, the distinguishing features of Producto machine tools, are built into the complete new line of Producto blow molding equipment!

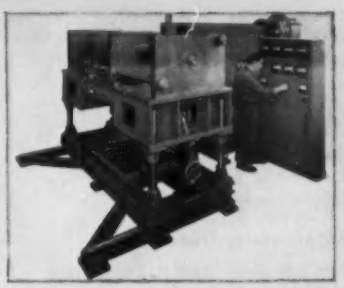
- Each molding press has 3-way micro-positioning adjustments for centering mold under parison.
- Each press also has positive, high-speed equalized opening and closing, insuring dead center mold alignment.
- High-speed horizontal in-line accumulator for perfect parisons. Self-cleaning.
- Three separate head adjustments regulate parison weight, concentricity and straightness.
- Platen "daylight" opening is adjustable. Accommodates dies of various thicknesses without shimming. Speeds set-up.
- Advanced head design assures trap-free flow of parison. No dead spots!
- Hardened steel head and flow passages are polished and hard chrome plated.

Eight models include 1, 2, 4 and 8 parison head arrangements. Capacities vary from mothball size to 80-gallon drum size! Building-block construction provides an unlimited range of combinations to suit your exact needs.

Be sure to see the most durable, accurate and trouble-free blow molding, reaming and accessory equipment ever offerred to plastics manufacturers! For additional information or to arrange to visit Producto, call FOrest 7-8675, or write today:



Flexible Versa-Blow series includes the single press Mod. VS-1



Producto's Magna-Blow* series for giant products. Mod. M-1 shown.

*Trademark

Long a famous name in the metalworking industry, Producto is recognized as a leader in the design and manufacture of die sets, special machines, and toolroom equipment.

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THE PLASTISCOPE

(*From page 360*)

neapolis, Minn. The new products have been designated Admex 752 and 755 by the company.

According to William Jarvey, manager of ADM's vinyl plasticizers, increased use of synthetic elastomers, including vinyl for automotive interiors, has led to closer evaluation of all components containing relatively low-molecular-weight raw materials. Greater window areas mean hotter interior temperatures in modern cars and volatility is becoming a significant problem. ADM's new Admex plasticizers will assist the compounder in producing more durable upholstery fabrics, extrusions, and moldings for all functional and decorative vinyl plastic items used in automotive interiors.

Oxo-alcohols for plasticizers

Plans to manufacture a variety of oxo-alcohols at its new Chocolate Bayou, Texas chemical complex have been announced by Monsanto Chemical Co. Oxo-alcohols are key ingredients in the manufacture of phthalate, phosphate, and adipate plasticizers. The new oxo-alcohol unit, scheduled to be on stream late in 1962, will be a captive facility capable of supplying all of the company's near-future requirements for these compounds.

The company announced last January that the hydrocarbon chemical complex, which will rise on its 3000-acre Chocolate Bayou site, will include major facilities for producing naphthalene and olefins such as propylene. Naphthalene is the raw material for phthalic anhydride, which is combined with the oxo-alcohols to yield a wide variety of phthalate ester plasticizers.

Maleic anhydride

The new multi-million dollar maleic anhydride plant of the Industrial Chemicals Div., Pittsburgh Chemical Co., at Neville Island, Pa., is now on stream. The plant has a rated production capability of 20 million lb. of maleic anhydride per year.

Pittsburgh Chemical Co. has been, for some time, an established producer of phthalic anhydride and fumaric acid. These and maleic anhydride are used as chemcial raw materials in the manufacture of polyester and alkyd resins, paints, plasticizers, agricultural chemicals, petroleum additives, and pharmaceuticals.

The start-up of the new maleic anhydride facility permits the Industrial Chemicals Div. to use the benzene production from the coke ovens of parent Pittsburgh Coke & Chemical Co., thus assuring a basic raw material supply position.

Cold punch laminate

Said to have stable punching properties over a wide range of low temperatures, high solvent resistance, and good reproducibility, a new paper base, phenolic laminate grade, Insurok T-755, has been introduced by The Richardson Co., Melrose Park, Ill. The new grade comes in unclad or copper-clad sheets, and is recommended for printed circuits, electrical, and electronic components. It is also used as cold punch material for terminal boards, instruments and for various appliance component parts.

Peroxide catalysts

Expansion of facilities to triple the output of BZQ-50 and BZQ-55, non-separating benzoyl peroxide paste formulations has been announced by U. S. Peroxygen Corp., Richmond, Calif. Increasing demand for the formulations, particularly among boat builders, industrial molders, and auto body putty manufacturers, has necessitated the boost in capacity.

BZQ is primarily used as a polymerization catalyst for monomeric vinyl, acrylic, styrene, and polyester resins, and copolymers of these resins wherever an ester type plasticizer is advantageous. The homogeneity of the paste is said to assure uniform concentration of benzoyl peroxide in each application, and eliminates over or under catalyzation.

According to the company, the paste is said to be useful as a polymerization catalyst for polyester resin laminates formed in heated molds; in the elevated temperature molding of polyester in matched metal molding, continuous laminating and reinforced pipe laminating, as well as in compression and transfer molding of polyester premix materials; as the polymerization catalyst for pre-impregnated fibrous glass or other reinforcing materials; and as a fast, durable curing catalyst when used in conjunction with auto body patching compounds.

All-purpose mold release

A new all-purpose aerosol mold release compound has been introduced by Magnus Chemical Co., Garwood, N. J. Called Mold-Slic, the product is reportedly a new type of silicone spray, formulated for ease and efficiency in releasing all common plastic materials from molding surfaces after curing.

Urethane insulating panels

Rigid foam-filled insulating panels, primarily for refrigerated highway trucks and trailers, railroad cars, and containers, are being manufactured by Insulfoam Inc., a newly established company at Keyport, N. J. The firm produces standard 4- by 8-ft. panels on a continuous system at the rate of 15 units per hour, and anticipates stepping up production to 30 units, after a break-in period.

Foam insulation for tanks

Curon polyester-type urethane foam laminated to 15-gage vinyl sheeting has been introduced as a new type of thermal insulation material for outdoor and indoor use on chemical and oil storage tanks and processing equipment. It is supplied by Reeves Brothers Inc., New York, N. Y., in 4- by 12-ft. sheets, 1 in. thick, and is recommended for surface temperatures ranging from 50 to 250° F. The vinyl sheeting provides the foam with a completely weather resistant surface that can easily be cleaned.

In installation, commercial mastic cement is first laid on the surface to be insulated. The sheets of Curon foam, each weighing only 12½ lb., are then applied by hand pressure. The foam readily conforms to a curved surface. It can be used on any metal or other material to which the mastic cement adheres.

Improvement for polyesters

A chemical that may be used to upgrade polyester resins for reinforced plastics has been announced by Shell Development Co. The compound is trimethylene glycol (1,3-propanediol). It is a premium-priced chemical of limited availability and is ordinarily made as a by-product of soap manufacture. According to Shell, however, TMG can also be made as a derivative of acrolein. It can be used in translucent laminates, wall dividers and awnings, and for boat hulls. TMG is said to decrease polyester preparation time and to improve toughness and resistance to fading in sunlight.

Adhesives for urethane foam

Adhesive compounds based on acrylic interpolymer latexes have been introduced by Alco Oil & Chemical Corp., Philadelphia, Pa., for bonding polyether or polyester foams to fabrics for thermal garments and to paper for insulated bags.

The advantages of the new adhesives are said to be: 1) no foam loss as

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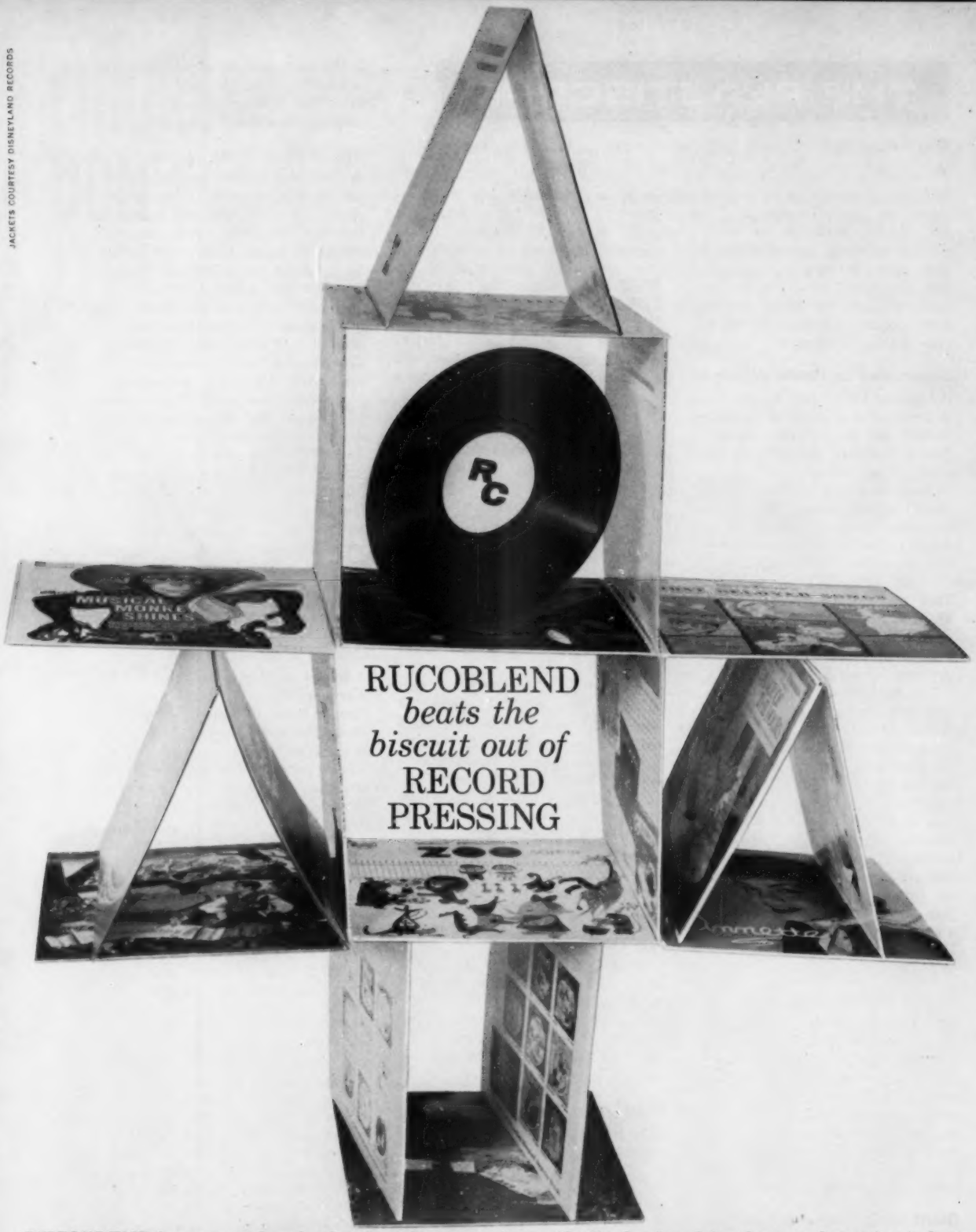

RUCOBLEND is a new ready-mix of resin and compound, specifically developed for the record pressing industry. No biscuit is needed! RUCOBLEND, transferred directly from the compounder into the press while still hot, eliminates cooling and re-heating, producing records with these improved qualities: ■ Superior Frequency Response ■ Lowest Surface Noise Level ■ Non-warping ■ Great Durability ■ Color Uniformity. Write for details today.

For *industry after industry*, RC research has solved the most intricate problems by developing new polymeric products and new production methods. If you manufacture plastic products, your first source of supply should be RC for Plasticizers—Comonomers—Vinyl Polymers—Copolymers—Vinyl Films and Sheetings—Plastisols—and Specialty Vinyl Compounds...*Ready...Reliable...RC Serving American Industry Since 1930.*

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THE PLASTISCOPE

(*From page 362*)

in fusion processes, 2) no expensive outlay for special equipment, 3) a more flexible hand for the finished product, and 4) the possibility of doing piece goods and odd sizes. All adhesives are applied directly to the polyurethane foam by either spraying, roller coating, stripping, or rotogravure printing procedures.

Decorative laminate diffusers

Polyplastex United Inc., Union, N. J., is introducing a series of decorative formed and flat diffusers, known as Panlam Diffusers, that offer an interesting design concept.

Polyplastex has laminated metallic fibers, sequins, natural foliage, and butterflies between sheets of vinyl to create a series of 16 standard patterns that are offered in formed 23⅜ by 23⅜ in. diffusers or in flat panels. They have a fabric surface texture which gives the diffusers a whiter and more brilliant appearance, lighted as well as unlighted, than is found in standard formed vinyl pans.

The diffusers offer new design freedom in lighting arrangements for residential use or for commercial applications such as restaurants, hotels, clubs, etc. The broad use of fluorescent lighting had been heretofore restricted in many of these areas because of the lack or prohibitive cost of decorative materials. The response to trial installations of Panlam Diffusers at the General Electric Co. Nela Park Lighting Institute, according to the company, has indicated an acceptance and a need for this type of material. Panlam Diffusers have been tested and rated by U/L.

New extrusion coater

The Specialty Papers Co., Dayton, Ohio converter of flexible packaging materials, has entered the field of extrusion coatings of polyethylene, polypropylene, and nylon with the installation of a Waldron-Hartig extruder-coater-laminator. Alexander B. Beal, formerly plant manager of the Lassiter Div. of The Riegel Paper Corp., will head up the new division.

Giant tank from stock

Availability in stock of horizontal 1000-gal. processing tanks, fabricated from a specialty bisphenol-A polyester resin reinforced with glass fibers, has been announced by Justin Enterprises Inc., Cincinnati, Ohio. The tanks, 10 ft. long, 50 in. in diameter, and with a wall section of ¼ in., weigh approximately 300 lb., compared to 2000 lb. for a comparable stainless steel unit, according to the company. Translucence, a feature of the tank, allows observation of the liquid level within the tank and elimination of liquid level gages.

Recommended as a processing unit for the paper, chemical, textile, metals, petroleum industries as well as agricultural, etc., where corrosive conditions necessitate a structure with high chemical resistance, the tanks, complete with manhole, stainless steel fittings, and mounting saddles, are priced at approximately $1000 each. Other capacities, ranging from 50 to 10,000 gallons, are also available.

Owens-Corning now makes panels

Announcement of a line of fibrous glass-reinforced acrylic panels for roof and sidewall lighting, and other industrial and commercial applications marks the initial entry of Owens-Corning Fiberglas Co. into production of finished panels. The firm has long been a major supplier of fibrous glass materials to other panel manufacturers. According to O-C the new fibrous glass-reinforced plastic panels are the first to use 100% acrylic resin as the bonding agent.

Computer punch tapes

A new line of non-magnetic computer punch tapes has recently been introduced by the G. T. Schjeldahl Co., Northfield, Minn.

The tapes are laminations of Mylar/aluminum and Mylar/paper, bonded together with a proprietary adhesive. It is claimed that the tapes have had low absorptivity and function perfectly at temperatures to 240° F., in humidity conditions up to 96%, and have not delaminated under severe operating conditions.

Plastic stops bullets

A tough plastic with "excellent bullet stopping properties" has advanced to the "promising" stage, according to Dr. William E. Hanford, vice-president for research of Olin Mathieson Chemical Co., who disclosed that it was one phase of the company's search for uses of a by-product.

In laboratory firing tests, this new plastic, in thicknesses of ⅝-in., has stopped a 30-caliber bullet at 5 to 20 yards. Further development work, however, is still necessary, Dr. Hanford said. If research in this area proves successful, he added, numerous applications, ranging from personal armor for military personnel to automobiles, have been suggested.

Plastic chair mats

A clear methacrylate pad for use on top of rugs to protect them against damage by chairs, especially in offices, has been introduced by Commercial Plastics & Supply Corp., New York, N. Y. under the designation Plasco. The new mats are made in a variety of popular sizes from transparent ¼-in. Plexiglas by Commercial's newest subsidiary, Florida Boat Windshield Co. National sales headquarters for these mats will be the Atlanta, Ga. branch of Commercial Plastics, but they will be sold through established dealers in the office furniture field. The Plasco mats come in a variety of shapes to fit particular office needs. Mats with extra wide lips or in custom shapes can be produced to specifications, but 20-in. lips will be standard. Prices depend on width and length requested, and vary from $42 for the single-lip mat, 36 by 48 in., to $98 for the double-lip type in 60 by 72 inches.

Course in adhesives

A review of the present knowledge of adhesion will be presented by the Plastics Research Laboratory of the Massachusetts Institute of Technology in a special summer program on The Science of Adhesion from June 26 through June 30, 1961. Tuition for this special summer session is $200, payable upon notification of admission. Academic credit is not offered. Classes will be held daily from 9 to 12:30, and from 2 to 5.

Container lids

Snap-in lids, made from opaque and translucent high-impact polystyrene in a full range of colors, and from opaque and transparent oriented polystyrene, are being manufactured by the Plastics Division of R-C Can Co., St. Louis, Mo. The new lids are being made for 8-, 12-, and 16-oz. tub type containers, which are widely used to package dairy and delicatessen products. A complete line of cover-all lids is also being produced for both hot and cold drink cups for carry-out service containers. Brand names and other identification can be imprinted in one to three colors. Special embossing is also available.

Flexible PE pipe

Production of flexible polyethylene pipe has been announced by Lasco Industries Inc., Los Angeles, Calif. producer of fibrous glass building panels and rigid plastic pipe. Roy A. Eastman, vice-president, said the company

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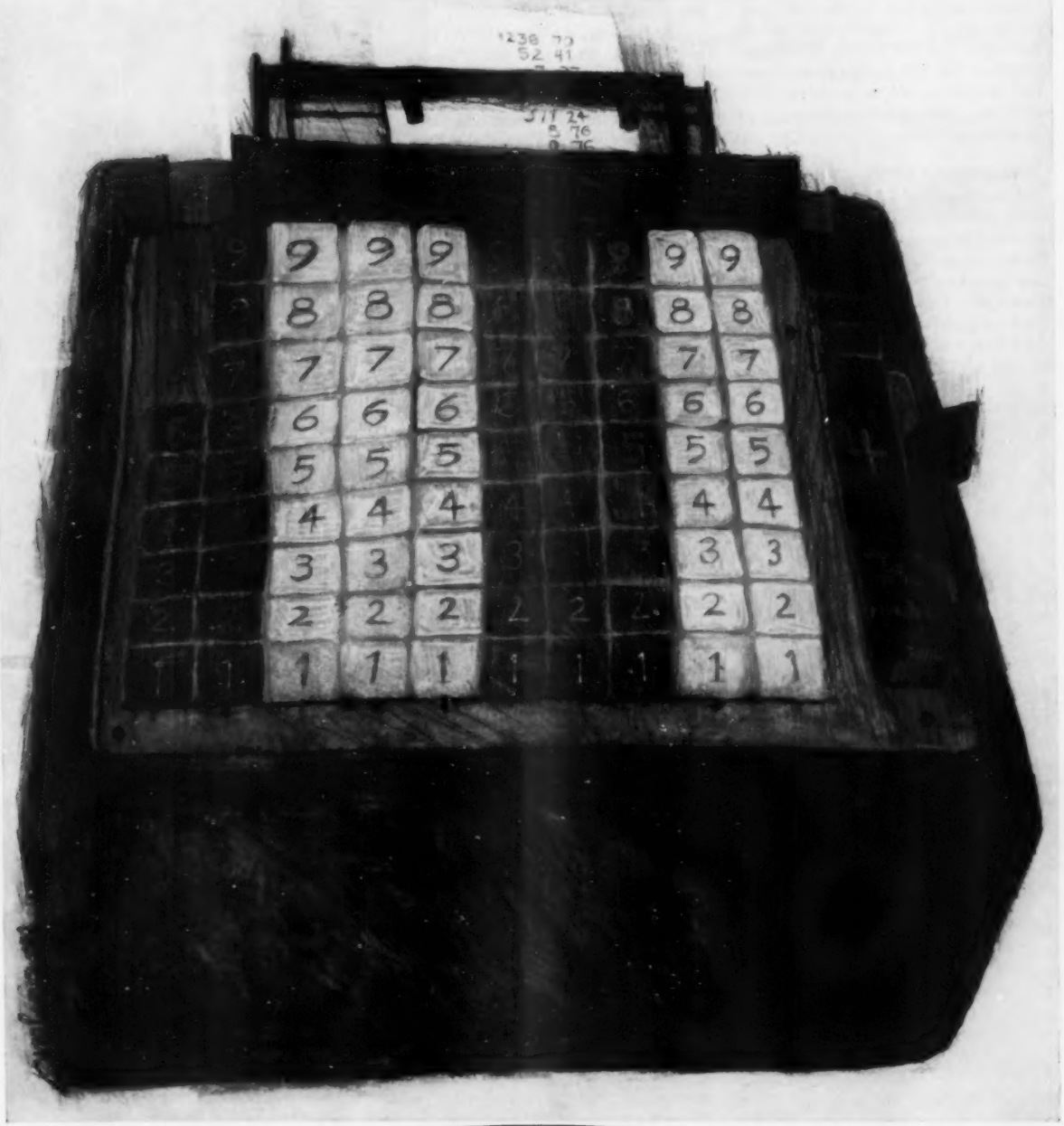
You save when you solve materials problems with Laminac® Laminac polyester resin has been solving difficult materials problems for 19 years — and delivering substantial economies in the process. Laminac is available in many formulations for hand-layup, matched metal die, spray-up, pre-mix, pre-preg, pressure-bag, and vacuum molding of business machine housings, furniture, food trays and countless other products. This pioneer polyester, reinforced with glass fiber, offers economical high and low-volume fabrication of unusual shapes, large and small. Plus: Low-cost tooling • Excellent electrical properties • High structural and impact strength • Corrosion resistance • Light stability • Fire resistance • Dimensional stability. Manufactured in Pennsylvania and California and stocked in warehouses in major cities. Write for two free booklets: "Laminac Selector"; "Laminac for Spray-Up Application."



AMERICAN CYANAMID COMPANY CYANAMID **PLASTICS AND RESINS DIVISION**

WALLINGFORD, CONNECTICUT. *OFFICES IN:* BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • LOS ANGELES MINNEAPOLIS • NEW YORK • OAKLAND • PHILADELPHIA • ST. LOUIS • SEATTLE • *IN CANADA:* CYANAMID OF CANADA LIMITED, MONTREAL • TORONTO

THE PLASTISCOPE

(*From page 364*)

is producing a National Sanitation Foundation-approved quality line as well as a utility line in diameters ranging from ½- to 2-in. and in varying coil lengths. The company's entry into the flexible pipe field follows the recent opening of new regional sales offices in the Midwest and Southeast and the appointment of new distributors.

Lasco previously emphasized production of rigid polyvinyl chloride and ABS pipe. The flexible pipe is designed primarily for use in agricultural and turf irrigation and as electrical conduit in residential and commercial construction.

Transparent vinyl insulation

Development of a new transparent vinyl insulation sleeving that is said to combine outstanding resistance to heat, fungus, and oil attack, has been announced by The Borden Chemical Company. Called Resinite Hi-Heat 105C, it is designed for electric motor insulation and over transformer leads in both ground and airborne electronic assemblies. The insulation sleeving is stated to have U/L approval and is claimed to surpass all specification requirements for MIL-I-631C Type F, Form U, Grade c, Classes I and II, Cat. 1. Its dielectric strength is rated at 1000 v./mil average. Working temperature is from 221 to —10° F., with continuous operations at 105° C. The material has a tensile strength of 2900 p.s.i. minimum, is self-extinguishing in 5 seconds. It is available in 10 colors in all of the standard sizes.

Enters glass fiber manufacturing

Pall Corp., Glen Cove, N. Y. producer of filtration equipment, has announced plans to enter into the manufacture of glass fibers. The company, through Fibrous Glass Products Inc., a wholly-owned subsidiary, will construct a $1,800,000 glass making and fiber drawing plant which will have a capacity of approximately 10 million lb. a year. Part of the output will be used by the company for its own lines; the rest will be available for general sale to other manufacturers. The new plant is expected to be in operation by January 1962.

PVC pipe for Freedomland

More than 25,000 ft. of PVC (polyvinyl chloride) pipe was used for the giant sprinkler system installed in Freedomland U.S.A., located in the Bronx, N. Y. This system supplies lawn and ground sprinkling, street washdown, and other requirements for the entertainment center.

Because this 205-acre section was formerly a disposal area and has a high salt water table, it was decided to use PVC instead of metal pipe. The plastic piping has excellent corrosion resistance, and it is also immune to electrolysis.

The Schedule 40, Type II PVC pipe, made by A. M. Byers Co., Philadelphia, Pa., was supplied in sizes ranging from ¾-in. diameter risers to 3-in. diameter main lines, with the latter accounting for more than 15,000 ft. of the total installation. The system operates at approximately 70 p.s.i. and will be filled with water from May to November each year. Lightweight, rigid PVC pipe was pre-assembled before being lowered into trenches 1 to 3 ft. deep, depending on terrain. "Snap-on" sprinkler heads were used. The sprinkler system was designed by Associated Irrigation Consulting Co., Los Angeles, Calif.

Penton-clad pipe

A wide-range line of Penton chlorinated polyether-clad pipe and pipe fittings to carry corrosive fluids or withstand corrosive atmospheres is available from York Industrial Plastics Inc., York, Pa. Schedule 40 steel pipe and cast-iron fittings are clad inside and out with Penton, a high-temperature plastic resistant to most chemicals. Some possible applications are for chemical processing, electroplating, steam and hot water lines, paints, oils, paper mills, power plants, steel mills, etc.

Penton, developed by Hercules Powder Co., provides excellent corrosion resistance to most acids, alkalies, and solvents at temperatures up to 250° F., depending upon the particular chemical element or compound.

Agree on WVTR tests

The correlation of WVTR tests has been accomplished by the Plastics Extrusion Coaters Group of the Specialty Paper and Board Affiliates Inc., New York, N. Y., through the use of a detailed test procedure which clearly specifies preparation of samples and weighing procedures.

Using General Food cabinets, various members of the Group have tested standard samples and sent in their results for correlation. The last three "round robin" tests indicate repetitive results with good correlation on flat WVTR tests, and also on creased WVTR tests.

Samples tested to date have included unsupported polyethylene film, polyethylene-coated multiwall bag stock, and PE-coated pouch stock.

Urea-formaldehyde for adhesives and coatings

The first three of an expected wide range of urea-formaldehyde concentrates are now commercially available from Hercules Powder Co.'s newly completed, multi-million dollar facilities at Hercules, Calif.

The initial three products are designed for the economical manufacture of many types of urea-formaldehyde resins for a variety of industries on the West Coast, including plywood, adhesives, furniture, paper, particle board, textile, and protective coatings. The three products differ in the content of formaldehyde and urea and solids content.

Plastics for valve components

Close-tolerance balls for check valve applications are being made by Industrial Tectonics Inc., Ann Arbor, Mich., out of Delrin, Lexan, nylon, and Teflon. Materials have been selected for chemical resistance, high lubricity, for quiet operation under light loads, and finishing qualities. Balls are finished to instrument grade tolerances of ±0.0005 in. on sphericity and ±0.001 in. on size, or as required. They are also used in light load bearings where non-magnetic and non-conducting properties are important, and as component parts for electro-mechanical assemblies.

Waterborne resin system for molds and cores

Commercial availability of a new resin-hardener combination designed to produce both hot and warm coated sand for shell molds and cores has been announced by Union Carbide Plastics Co., Div. of Union Carbide Corp. The resin, Bakelite phenolic resin BRL-5009, is waterborne; the hardener, developed especially for use with the resin, is designated BRP-0314. The combination can be processed in a variety of sand mullers with hot air supply; it can also be used with preheated sand.

According to Union Carbide, the new system produces a highly efficient distribution of resin. There is only a thin film of resin on the sand particles, insuring a fast melt, a fast flow, and a fast bond.

Refrigerator truck liner panels

Fibrous glass reinforced modular panels for refrigerator truck and trailer liners, with integral air-circulating ribs and **(To page 370)**

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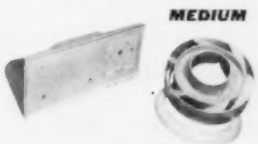
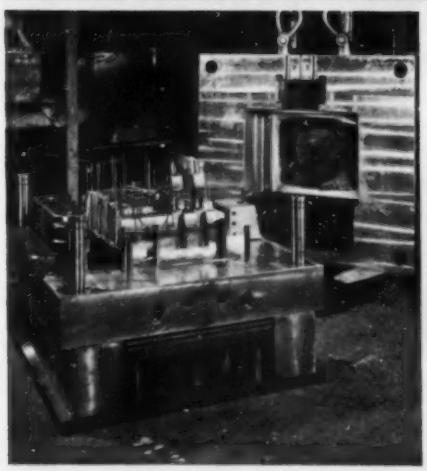


MEDIUM

SMALL



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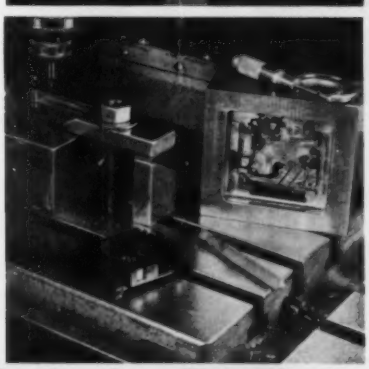

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THE PLASTISCOPE

(*From page 366*)

a nesting edge for efficient installation, have been developed by Molded Fiber Glass Body Co., Ashtabula, Ohio. Advantages claimed for the panels are hardwearing gloss-white surface, easy cleaning and maintenance, excellent thermal insulation, high strength and rigidity at high and low reefer temperatures, and quick in-place repair in case of forklift damage.

The MFG panels are available in two sizes: 37¼- by 84-in., and 49¼- by 84-in.; both are 0.120-in. thick. The smaller panel has 4 ribs on 9-in. centers; the larger unit 6 ribs on 8-in. centers. The 48-in. panels range in price from $19.00 in quantities of 1000 panels or more, to $24.50 for orders consisting of less than 25, f.o.b. Ashtabula.

Thermoset acrylic coatings

Pilot plant quantities of 2-hydroxyethyl methacrylate (HEMA) and 2-hydroxypropyl methacrylate (HPMA) are now available, according to an announcement by Rohm & Haas Co., Philadelphia, Pa. These compounds are proposed for use as functional group monomers in the production of various copolymers and as chemical intermediates.

HEMA and HPMA can be polymerized in solution or emulsion with a variety of monomers to give copolymers that then can be reacted with OH-reactive bifunctional chemicals to form thermosetting plastics as well as elastomers.

The new functional group monomers are of particular interest in the development of thermosetting acrylic coatings, wool stabilization formulations, binders for non-woven fabrics, and other polymeric products.

New plant for fibrous glass fabric

Clark-Schwebel Fiber Glass Corp. has commenced production of industrial fibrous glass fabrics at its new $3½ million weaving and finishing plant in Anderson, S. C. This is reportedly the first plant designed and built exclusively for glass fabrics and equipped with machinery engineered specifically for fibrous glass weaving and finishing. It is located on a 20-acre site chosen in consideration of future expansion possibilities. The plant includes a plastics research and testing laboratory, and is staffed by a supervisory team of 14 experienced fibrous glass production personnel. Total employment planned by the end of this year is approximately 400.

Clark-Schwebel Fiber Glass Corp. was organized last July by R. F. Clark, president, and J. P. Schwebel, executive vice president. The company will produce fibrous glass fabrics, woven roving, and glass tape for high- and low-pressure reinforced plastics, electrical insulation, coated fabrics, etc.

Plastisol price cut

Metal & Thermit Corp., Rahway, N. J., has reduced prices on its Unichrome 5300 Series spray-applied plastisol coating materials from 83¢ to 75¢/lb. in 1-gal. quantities, and from 67¢ to 59¢/lb. in 100-drum and larger shipments, f.o.b. Carteret, N. J. Coupled with the price reduction is a change in viscosity characteristics said to improve handling.

M&T's Unichrome plastisols are liquid organic materials that are used in the product finishing field because they are said to have superior protective and decorative properties and to be easily handled during production operations.

Vinyl-surfaced gypsum grainboard

Sales of "about $3 million" this year were predicted by a National Gypsum Co. official for its new vinyl-surfaced gypsum grainboard. Called Gold Bond Vinyl-Guard, it follows the introduction of Durasan, the company's first vinyl-surfaced decorative gypsum wallboard (see p. 85, MPI, Dec., 1960). The new paneling consists of a core of fireproof gypsum wallboard covered with a vinyl chloride plastic coating in a simulated grain finish. It can be used in new home building, in the construction of office buildings where low maintenance cost is an important factor, and by the do-it-yourselfer to finish off an attic, make a game room, or cover an existing wall. According to the company, the new product is highly resistant to scuffs and stains.

U.K. rep. for Swedish machine

The Projectile & Engineering Co. Ltd., London, England, and European Plastic Machinery AB, Malmoe, Sweden, have signed an agreement naming the Sales Co. of Projectile-Peco Machinery Sales (Westminster) Ltd. as sales agents for the Peco-Euromatic Blow Molding Machine in the United Kingdom. Manufacture of the machine will begin in the second half of 1961. Peco will eventually handle sales throughout the world with the exception of Scandinavia, Finland, and Iceland. A description of the machine will be found on p. 48 in the Jan. 1961 issue of MODERN PLASTICS.

East German chemicals

A licensing agreement on the use of chemical processes has been reached between Humphreys & Glasgow Ltd., an international firm of contracting engineers, and Limex, an East German state trading corporation.

Leslie R. Thomas, an executive vice-president of Humphreys & Glasgow, said, "The American chemical industry, through Humphreys & Glasgow, now has access to some 60 processes for the production of acetylene based chemicals, acrylonitrile, vinyl compounds, chlorine, emulsion resins, synthetic fibers, caprolactam, acrylics, and many other polymers and chemicals." The agreement is reciprocal—it provides for the purchase of Western processes and know-how by the German Democratic Republic with the assistance of Humphreys & Glasgow. North American headquarters for Humphreys & Glasgow Ltd., is Leslie St. at Sheppard Ave., Don Mills, Ont., Canada.

It was Limex which signed an arrangement with Simon-Carves in England for the erection of four PE plants in East European countries. I.C.I. is to supply the Soviet satellites with its PE manufacturing secrets for use at the plants, each of which will have a potential of 24,000 tons a year.

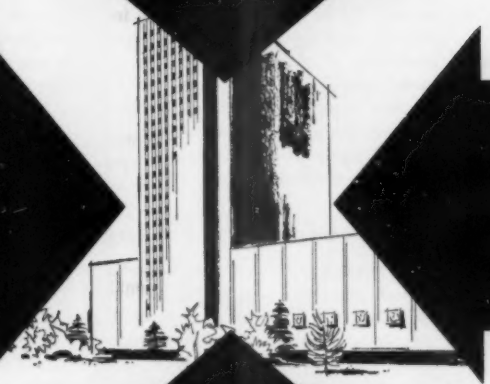
Now produces thermoplastic shoe parts

O'Sullivan Rubber Corp. reports that net sales for the company during 1960 showed a $215,060 increase over the previous peak year of 1959. Total net sales for 1960 were $8,893,419, compared with $8,678,359 the previous year. In its recently issued annual report, particular emphasis is given to the company's entry into the shoe industry's newly-developing thermoplastics field.

The report points out that O'Sullivan's Plastics Div. continued to expand during 1960. This expansion included the acquisition of all outstanding stock of Gulfstream Plastics Inc., a Florida injection molder. Gulfstream will continue operations at its Hialeah, Fla. plant. In addition, it will produce injection molded items in Winchester, Va. O'Sullivan will utilize these facilities to make thermoplastic shoe heels and soles.

The 64-year-old Virginia company's PVC promotion is emphasizing the product's adaptability to conventional shoe manufacturing machinery; its

COME SEE WHAT'S NEW IN PLASTICS



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9TH NATIONAL PLASTICS EXPOSITION NEW YORK COLISEUM JUNE 5-9 1961

THE PLASTISCOPE

(*From page 370*)

profit making appeal to the retailer through customer attraction and sales benefits; and its consumer pull through test-proven long-wearing features. Aside from the manufacturing viewpoint, the company also has geared its campaign toward eventual inclusion of the shoe repair industry, noting that conventional soles or heels can be replaced readily with polyvinyl chloride products.

Estane toplifts

New Estane toplifts for women's shoes have been introduced by B. F. Goodrich Industrial Products Co. under the tradename Novitane. Estane, developed by BFG, is a polyurethane elastomer material with outstanding resistance to abrasion. According to the company, the Estane lifts—the final section of the heel that comes in contact with the ground—do not spread or develop sharp edges under impact. The new product reportedly has enough resiliency to absorb some of the impact shock caused by walking, yet is firm enough to "click" with every step.

Self-adhesive urethane foam

Flexible urethane foam with self-adhesive backing is now being offered by Air-O-Plastik Corp., Union City, N. J., for cushioning, insulating, and sealing applications. The pressure-sensitive urethane foam, after removal of its paper backing, adheres firmly to any clean, dry surface. At the moment, weather stripping looks like the biggest market for this product. Other fast-growing applications are gasketing, case liners, display items, teaching and lecture aids, dust seals in television sets, sound deadeners under car hoods, and insulation in gas detection equipment. The foam can also be attached to walls and roofs for acoustical purposes and used to seal seams on air conditioning ducts.

Sub-zero dimensional stability provided by foam

A new urethane insulating foam, providing dimensional stability at sub-zero temperatures in a low-density formulation, has been developed by the Plastics Div., Nopco Chemical Co., North Arlington, N. J. Claimed to be a new development in the insulation field, the new foam eliminates shrinkage—formerly the major problem in sub-zero applications.

Designated Lockfoam H-602, the formulation is expected to open the way for expanded use in insulating such items as refrigerators, freezers, frozen food lockers, refrigerated warehouses, highway trailers, and refrigerated railroad cars. The foam, which is said to eliminate the collapse of cell walls at and below zero degrees caused by drastic condensation of entrapped gas, affords advantages in an overall density of only 2 lb./cu. foot. Formerly, an overall foam density of at least 2.5 lb./cu. ft. was needed for sub-zero applications. At these temperatures, a substantial increase in foam density had been necessary to produce more rugged cell walls. This solution, however, added new problems of higher cost as well as an increase in weight.

Plasticizer and starting material offered

Texanol (2,2,4-Trimethylpentanediol-1,3-monoisobutyrate) and a polyester plasticizer TXP-126 (derived from Texanol) are now commercially available from Eastman Chemical Products Inc., a subsidiary of Eastman Kodak Co., Kingsport, Tenn. The new material will be made in a new multi-million pound production facility at Eastman's Longview, Texas plant.

Eastman anticipates that Texanol will be used largely as a starting material for the production of a variety of polyvinyl chloride plasticizers. The 12-carbon ester/alcohol is readily esterified, producing relatively high-molecular-weight compounds with properties intermediate between monomeric and polymeric plasticizers. Plasticizer TXP-126 has a molecular weight of 530. Texanol is priced at 17¢/lb. in tank-car quantities; TXP-126 at 35¢/pound.

. . . more from the Packaging Show

The Packaging Industry has become such an important part of the plastics industry that it is well nigh impossible to write it off in the two pages printed in Section I of this issue. More details concerning some of the items mentioned there and some additional observations are given below. Even so, many good items are omitted since a complete coverage would require a book. It should be made clear that we are reporting on materials only with scant attention paid to processing techniques, most of which are covered at various times in this magazine's sister publication, *Modern Packaging*.

Polystyrene for packaging grows and grows. Injection-molded and formed polystyrene (PS) containers are now commonplace at any packaging show in practically tonnage lots. The big new splash in 1961 is in foam. For example, Monsanto states that its Santofome (a foamed film or plastic "paper") facilities are now running around the clock. A new unit to make 60-in.-wide stock will be installed this fall. Santofome is being used for packaging fragile items, such as optical lenses, for layer-separating candies and cookies, for picnic plates, gift wrapping, and formed containers. One machine is producing 22 million paper cups a week with a Santofome liner. In general, it looks like one of the fastest-developing products in the polystyrene field.

Another item is Visking's Visolyte, a laminated PS film and foam used for window envelopes, overwraps for fruit, chicken parts, sweet corn, etc. It can be put through a shrink tunnel and adhered tightly to the package. Applied Research & Development Corp., Chippewa Falls, Wis., exhibited an extruded PS foam in thin gages which can be formed into tiny compartments for dedicated parts, laminated to PS film for use as an ice cream carry-out package, or as a vending machine tray for hot and cold dishes. Another item to be classified in what could be called this extruded foam-film field is Dyna-Foam's Xanfoam, now being used for formed packaging components.

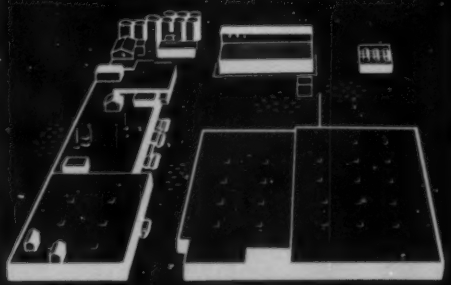
Plax biaxially oriented PS film and sheet has apparently made tremendous gains in the formed container field, and in the comparatively new cold-formed trays or cartons that are supplied in blanks similar to paperboard blanks used in folding cartons.

Growing outlets for PE film. Bread wrappers still consume only a small amount of PE when considering the huge potential market—somewhere between 250 and 300 million lb./yr., including 60 million lb. or more now in cellophane. But progress seems inevitable once bakers learn how to handle PE economically on altered or new wrapping machines. One producer at the show wrapped loaves at the rate of 40/min. with 1-mil film to demonstrate anti-blocking and good folding features of film that is made from his resin.

Wrapping for paper products has grown from around 2 million lb./yr. two years ago to something like 8 million lb., with a potential of 15 million by 1964. In this field, PE is replacing cellophane and paper.

At least one producer is still working on a 10-mil heavy-duty bag from PE to improve sealing **(To page 375)**

VINYL RESINS



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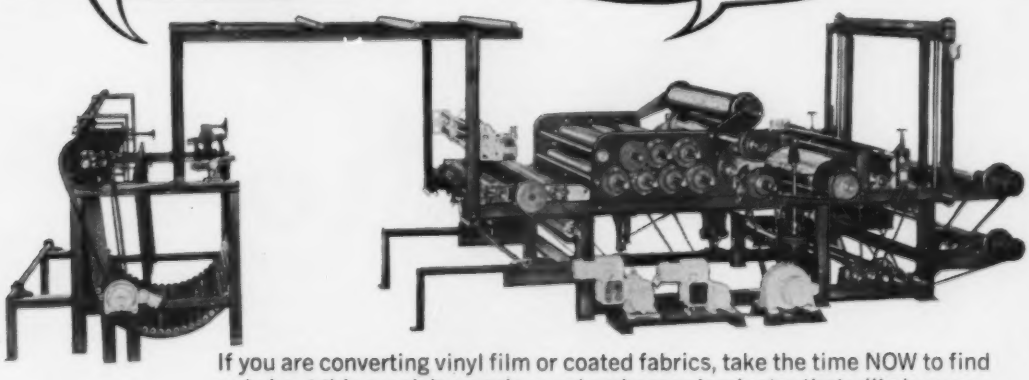

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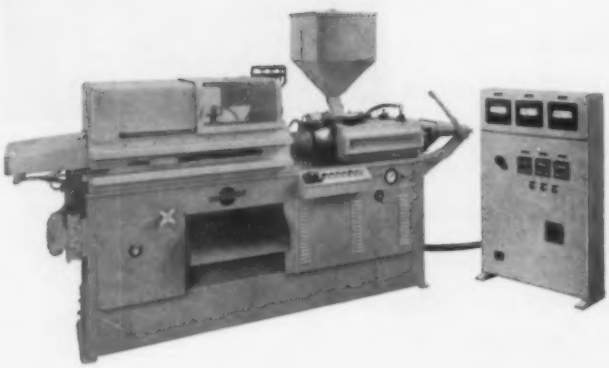

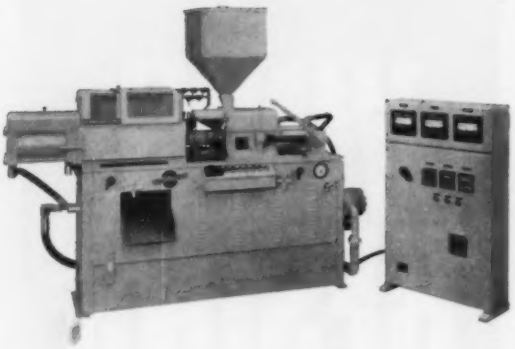

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(*From page 372*)

properties. Each bag contains ½-lb. of PE and costs more than multi-wall bags. But the product still has possibilities because of its superior qualities. The high-density producers are boosting their 5- or 6-mil bags and are advocating shipment of cabbages, carrots, etc., in 50- to 60-lb. quantities per bag. Another encouraging growth is expected in heavier-gage film for skin packaging of industrial products. An example of the last is sealing dishware to corrugated board to eliminate excelsior in moving operations.

One of the best examples of persistent endeavor was shown in the Koppers booth, where a fin- or edge-sealing machine was used to flat-wrap textiles and individual crackers—like those used in restaurants—at a rate of 200 units per minute. The film used was Conolex made from Koppers' Ziegler-type high-density resin, which for one reason or another has been difficult to develop. It now looks as though high-density film may finally have found its place in the market for certain applications. The trick in sealing seems to be to keep the heat below the melting point and use pressure to hold the film. Hot wire sealers are used for cut-off and serration. The price is about one-third less than cellophane on a yield basis or 3¢ versus 2¢ per 1000 sq. inches.

The bottle situation received new impetus from E. E. Winne, vp. of W. R. Grace & Co., who asserted that, since PE containers have now virtually taken over the packaging of light duty detergents and are moving into the liquid bleach market, the next step is to take over a substantial part of the industrial container field now being served by glass carboys, steel drums, and pails; and a good reason—aside from performance—is that plastics resins are maintaining their price level, or even declining, while metals and other materials are going up. Another advantage listed by Mr. Winne was light weight. A case of four 1-gal. conventional glass containers weighs 54 lb., compared with 38 lb. for PE. Lighter weight also makes more units per load by truck or rail shipment. He said that blow-molded industrial containers of high-density PE consumed close to 1 million lb. in 1960, that new compounds and development of suitable fabricating equipment point to a possible 40-million-lb. market for industrial containers in 1965. In addition, he said that laundry bleaches, heavy duty detergents (washing machines), disinfectants, ammonia, and

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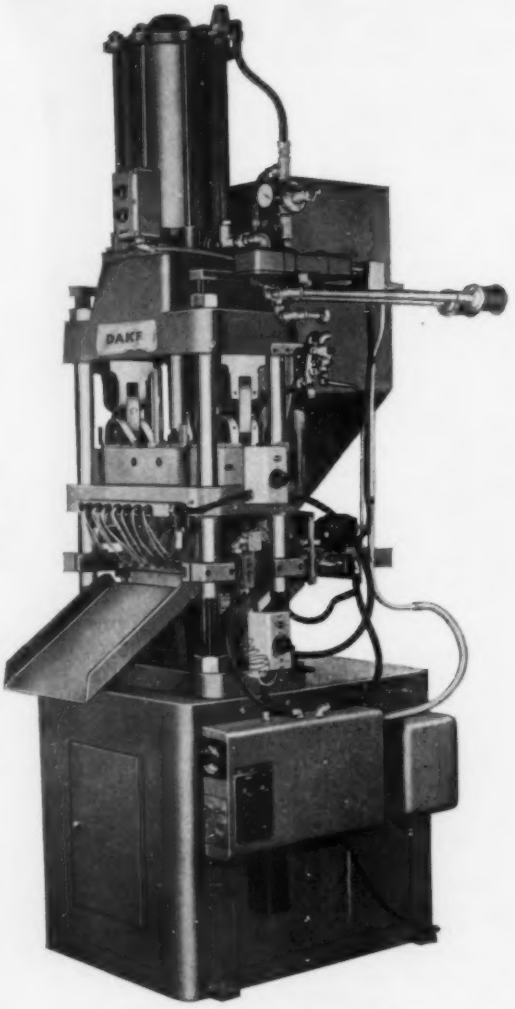

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(50 tons capacity)

The new 49 Series of Dake presses is engineered for fast, dependable, economical molding of phenolic, urea, alkyd and epoxy compounds. You get more production with less maintenance *at lower cost!*

Take production, for example. Several users operate these presses on a fully automatic basis . . . 24 hours a day, 7 days a week. There are no rest periods, coffee breaks, washups or lunch times; so Dake's plastics molding presses deliver up to 14% more work than semi-automatics. In addition, they are the most reliable and have the fastest dry cycle speeds. Opening, unloading, filling and closing to the "slow close" point all take place in *less than four seconds.*

Maintenance costs are reduced, too, because of the simplified, air-operated toggle design. The feed tray is actuated by positive cams through the same mechanism, eliminating the need for additional feed cylinders and control valves.

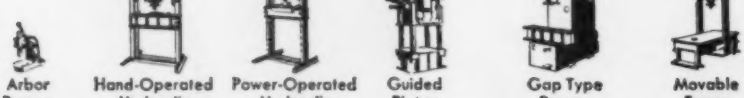
And look at the savings. Your initial investment is lower than for other automatic presses of equal capacity. More important, one man can operate a battery of presses because a Dake plastics molding press requires only a fraction of a man's time to load the hopper and remove molded parts.

Dake's nationwide sales organization will be happy to acquaint you with these superior automatic molding presses, and serve you on the complete line of other Dake plastics presses.

Write today for a free copy of Dake's compression molding "Data Book". It discusses the economics of automatic thermoset molding, gives case histories, and explains many features and advantages of the Dake 49 Series.

DAKE CORPORATION
648 Robbins Road, Grand Haven, Michigan

DAKE PRESSES



Arbor Presses · Hand-Operated Hydraulic · Power-Operated Hydraulic · Guided Platen · Gap Type Presses · Movable Frame

(From page 375)

waxes would soon follow light detergents (for dish washing) into adoption of PE bottles. Blow-molded PE bottles will be used for about one-third of all liquid household laundry bleach produced this year, representing about 35 million lb. of resin; 40 or 45 million lb. are used for light-duty detergents. By the end of 1962 the bleach bottle alone could be consuming resin at a rate of 90 to 100 million lb. annually.

The varieties of shapes and sizes in blow-molded items have to be seen to be appreciated. Containers with foam packing for missiles, vats, boats, large toy automobile replicas, and many others are now commercial. Companies are even using 8½-in. extruders to feed into 50-lb. accumulators for production of blow molded items. An interesting variation was a specialized container—a 5-gal. collapsible bottle for storing and carrying liquids and solids. Called the Water Boy and a product of Water Storage Container Co. of Cleveland, the unit, when not filled, can be collapsed to occupy one-tenth the space required when full.

New techniques and processes are in the early stages of development. And even resin types may undergo change in the near future. At present, most of the resin used for detergent bottles is 0.948-density Ziegler-type, or 0.950 copolymre based on the Phillips type. These resins were developed especially to prevent stress cracking caused by chemicals used in light detergents. But there are experts who believe that such extreme stress cracking properties are not always needed in other items. Bleaches, for example, do not contain such strong chemicals. But bleaches are generally sold in larger containers. Therefore, they might be made in 0.960-density, which is less costly for a low-pressure producer to make than 0.950. The bottle could have a thinner wall, but would be stiffer. Perhaps a 0.955-density could give the necessary compromise between stiffness and stress cracking and still be made at the same price as a 0.960-density resin. And there is even the possibility of a 0.939-density high-pressure resin. This experiment will take time, experience, and chance-taking, but it is a definite possibility.

Along this line is the announcement made by Union Carbide during the show of a new PE compound for blow-molded bottles of 0.960 density that sells for 35 cents. It is said to

From Wyandotte Key Chemicals

urethane foams for over 4 million 1961 cars

Yes, more than 4 million 1961 cars will have urethane foam parts in them using Wyandotte Key Chemicals. Why? Because these foam manufacturers have found that they can get higher quality at practical costs with Pluracol® polyols—diols, triols, tetrols, hexols. And their customers like the results. May we help you up quality and keep competitive in urethane foams?

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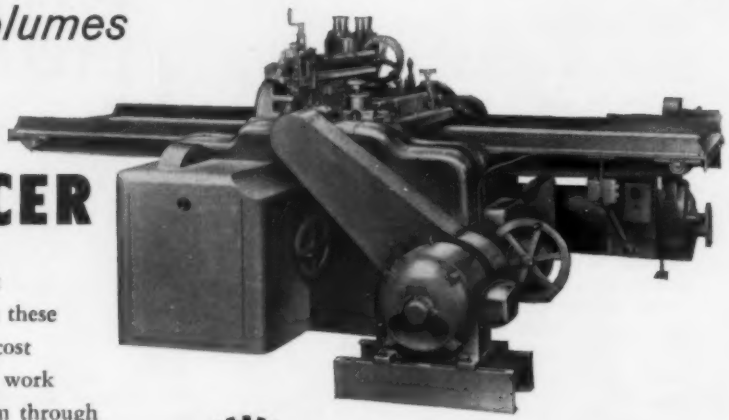
on the **BUSS MICRO-SURFACER**



Grinding and sanding plastics and thin-sheet materials is obsolete. Now you can machine these products faster, more accurately at far less cost with the Buss Micro-Surfacer. The vacuum work table flattens flexible materials, feeding them through carbide cutterheads which rotate at high speeds. Assures smooth, precision surfacing, at high feed rates and to close tolerances. Materials to 72" wide are machined at required feed rates. Shavings vanish through an efficient exhaust system. Investigate the Buss Micro-Surfacer . . . eliminate obsolete surfacing operations now.

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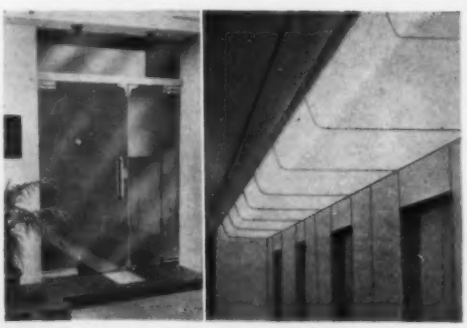

Characteristics :
Cheaper than any other organic glasses such as methacrylic resin, yet, superior to them in hardness, transparency, operation, heat and chemical resistance. Colored glasses are also available.

Most suitable material for
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Manufacturer : **DAIWA POLYGLASS INDUSTRIAL CO., LTD., Osaka**

(*From page 377*)

have better stress-crack than general-purpose materials and to be useful for bleach, liquid starch, and other household products where extremely high stress-crack is not required. It is characterized as a medium-plasticity material with a melt index of 0.7, with adequate test drops for a container wall that was 34 mils thick.

The tremendous speed with which PE detergent bottles grew into their market and the comparatively low cost of getting into the business has brought with it the usual problem of over-capacity in processing equipment and the resultant evils. The industry grew so fast that sufficient processing equipment wasn't quickly available but that situation has already disappeared. There are now said to be at least 120 blow molders along the Atlantic Coast to as far west as Ohio. There are probably more than 200 in the U. S. and more in prospect. Some of them are doomed to be pinched off when competition becomes rough and big users may start making their own bottles. But a potential market of perhaps 500 million lb. sometime late in the 1960's is big enough to support a good volume business. If the bankers don't try to put everybody with an extra dollar into the business it may work out quite well for most of the fabricators.

Polypropylene film is still too new for major use, but both oriented and unoriented was exhibited in various booths. Ward's chain bakery is using this film for wrappers on nine varieties of bread, in five or six different locations, on slightly altered cellophane wrapping machines. Fair amounts are being used for wrapping paper products. Boil-in-the-bag pouches are under trial. Blister packaging is a possibility. Double oriented film for produce wrapping where shrink is important is another good potential. But so far PP film seems to be pointed at the cellophane market. Guessing on the future for PP film depends so much upon further development of processing techniques and lower cost of the resin that it is fruitless to attempt prognostications on volume. But this much seems clear: it will have to go far afield from present cellophane applications if it is to achieve the volume that seems to be expected.

Polyethylene coated paper. This product was not as obvious as PE film at the exhibit but it was there in generous quantity. No one yet has been able to give a good estimate on just how strongly PE-coated paper

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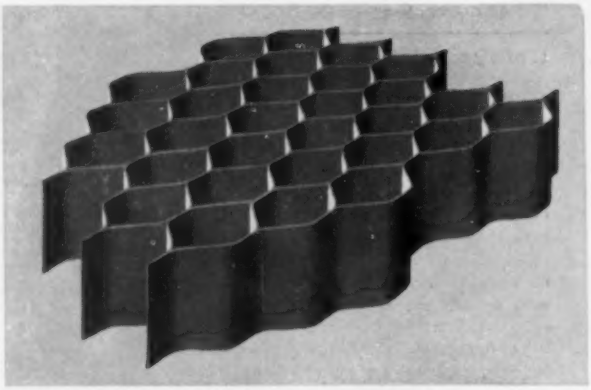
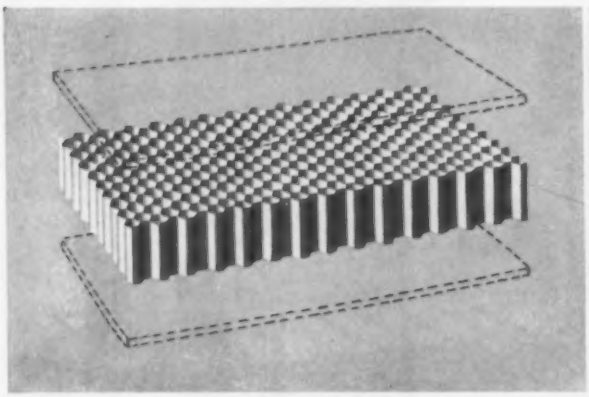
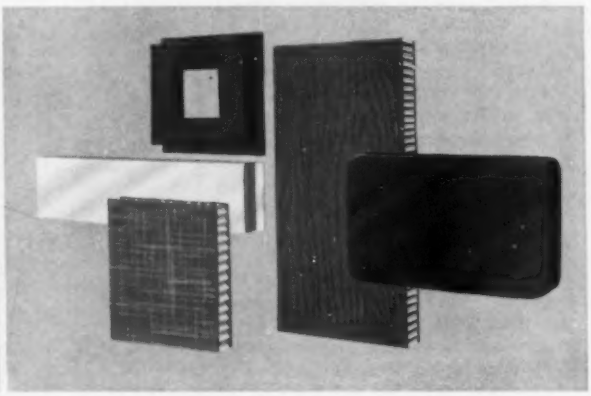
Douglas is the only manufacturer of honeycomb and honeycomb products that offers the varied services illustrated here. All Douglas contracts guarantee in writing adherence to your engineering specifications relating to your *Aircomb* or *Aircomb* product order.



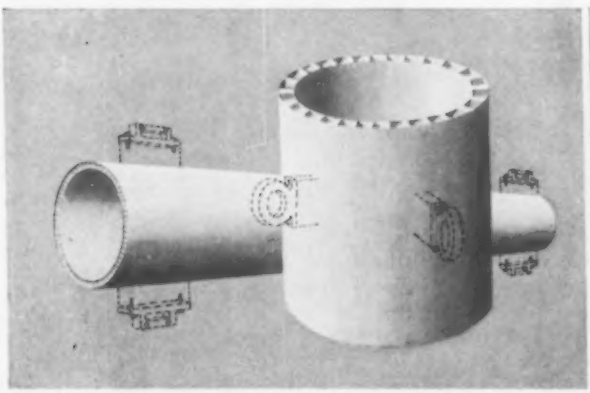
Core material—Aircomb *is highly-uniform phenolic-impregnated Kraft honeycomb. It is the only material of its type guaranteed for quality, strength and compliance with government and military specifications.*



Products incorporating customer-furnished material—Aircomb *can be bonded to an almost unlimited variety of plastics or other laminating materials as thin as .005". Douglas will combine* Aircomb *with your plastic materials as desired.*



Finished panels—*Douglas will deliver* Aircomb-*cored panels to your specifications.* Aircomb *panels insulate against temperature changes, relative to thickness, better than any other known material, while maintaining integrity.*



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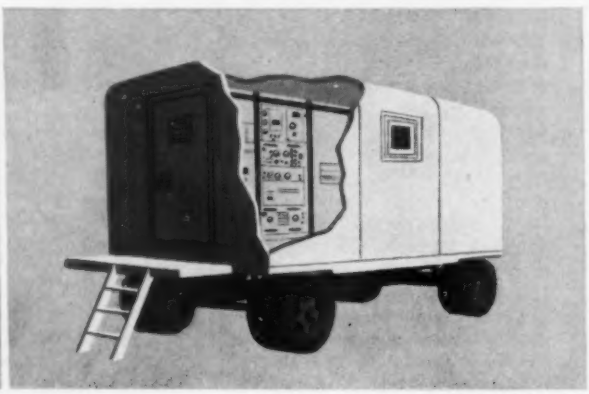

Complete products—*Douglas is prepared to manufacture complete products incorporating* Aircomb *to your exact specifications. Many companies are taking advantage of* Aircomb's *great strength, high rigidity and light weight.*

DOUGLAS AIRCOMB®

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(*From page 379*)

will compete with PE film, but there are suspicions that the battle will become more and more severe. A case in point is multi-wall bags where PE-coated paper is now moving strongly, even though there is a great effort to move solid PE film into the field. A perhaps significant exhibit in a different field was a PE-coated paper for bread wrappers. It was not low-molecular-weight PE wax, but a regular conventional type resin. This could bear watching.

The largest prospect in this field at present is PE-coated board milk cartons. This seems an ideal application, with PE generally recognized as the superior coating material for the job. But it will take time before present carton producers will change over their equipment. At present there are only 20 machines working on the PE application. PE-coated board for frozen berries and other frozen food is already in use. This could grow considerably, especially with the development of printing on the coated surface instead of printing on the board prior to coating.

A new wrinkle in PE coating was presented by Olin, which showed a film coated on both sides with a polymer to give resistance to passage of oils, greases, gases, and flavors. According to the company the film has transparency and surface gloss superior to standard PE. It is expected to be used particularly for wrapping nuts, candy, and dried fruits; and it may develop other uses because it is an effective barrier to the passage of odors from vanilla, onions, and vinegar.

Apropros of PE coating, it was noted that Monsanto had just announced two new PE resins for extrusion coatings and laminating which are claimed to impart resistance to moisture vapor, grease, and oil, as well as offer heat stability. In fact, almost every producer has been active in producing new resins for this field. which is expected to grow from about 50 million lb. in 1960 to at least 125 million lb. in 1965.

And not to be overlooked is the lower molecular-weight PE, which is being promoted by Tennessee-Eastman for hot melt coating of cut pieces of board, such as pre-cut cartons. From 2 to 20% PE is used with wax and it is intended for short runs or specialty jobs. It should *not* be confused with conventional emulsion coatings. Still another PE variation (although almost any thermoplastic can be used **(To page 385)**

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urethane foams for insulating new 1961 refrigerators

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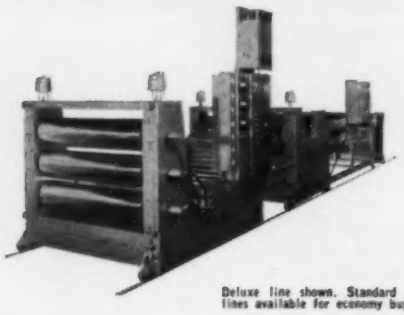

Deluxe line shown. Standard lines available for economy buyer.

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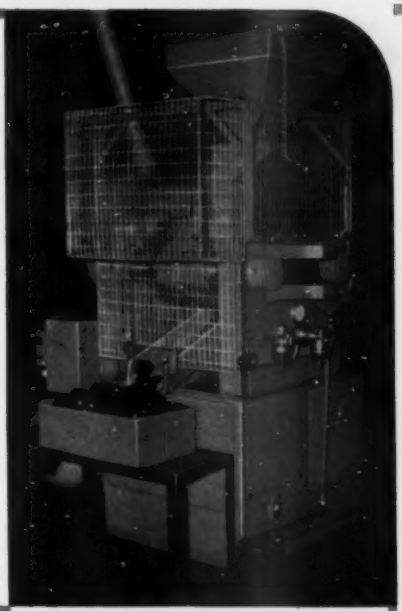

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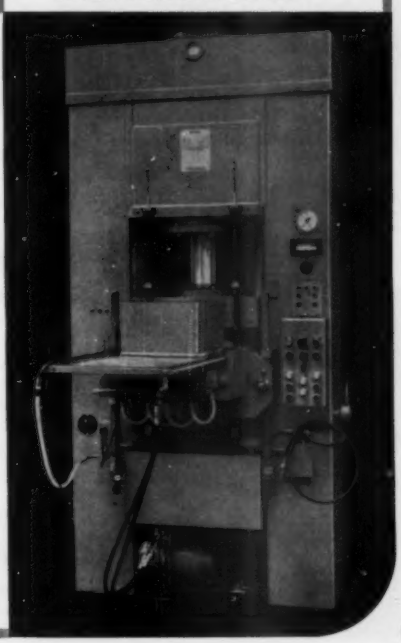

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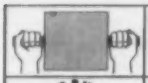

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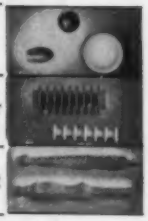

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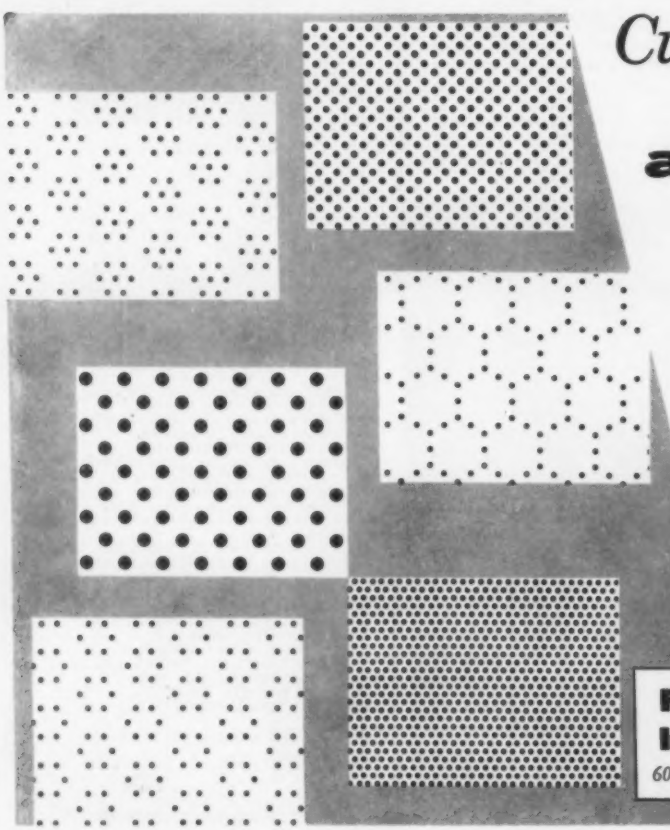

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(*From page 381*)

for the job) is Du Pont's Vexar, an extruded netting now going into produce packaging. As an example, sweet potatoes are being pre-packaged in 3-lb. consumer units. They are said to deteriorate in film bags, but the Vexar permits ventilation. It is also used as sleeves on glass containers (wine bottles, for example) to help reduce breakage in-transit. In the cosmetic market it is used in semi-rigid piping form as a material for hair curlers.

Injection molding vs. pressure forming. Any injection molder who investigated the Packaging Show must have squirmed at least a little bit when he saw all the formed pieces, most of which would be injection molded if pressure forming had never come along. Yet despite the competition from pressure forming, injection molding of containers and related packaging items is showing a healthy growth. A tiny item, such as a molded PE disk to replace cork in bottle caps, is an example. Molded six-pack carriers for beer and soft drink cans of both PE and impact polystyrene (PS) look exciting. Still another interesting small size item was a safety cap for medicine bottles molded in two pieces. The outer cap is high-density PE, and the inner cap is C-11 that locks with lugs on the outer cap so that the cap itself has to be pressed down and turned in order to open.

But in the fast-moving fields of disposable packages for cottage cheese, gelatin desserts, and many other types of ready-to-serve foods, thermoforming and injection molding appear to be locked in a classic struggle, with the present outlook tipping the scales in favor of thermoforming on the basis of economics, lower mold costs, and greater flexibility.

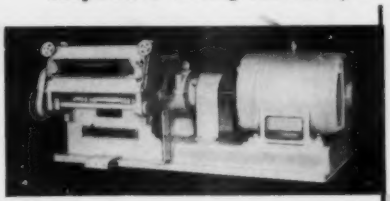
However, the injection molders have taken to upgrading and "personalizing" stock containers to adapt them for a particular product. For example, Creative Packaging Inc. exhibited dozens of re-usable hinged molded PS containers with colorful imprints on the lids to identify product and manufacturer. The containers were further personalized by means of platforms or inserts of various kinds, mostly foam, to fit the exact contours of the product. The increasing availability of polypropylene will certainly add to the interest in built-in hinged containers.

Injection molders also can do many things beyond the scope of thermoformers—at least by present techniques. An example was the Dura-Pak large containers, **(To page 388)**

an outstanding line of equipment that's pace-setting in performance, adaptability and low-cost operation

for profit-making installations

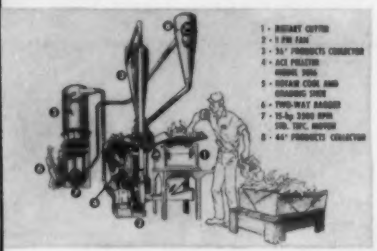
Sprout-Waldron offers you . . . creative engineering and know-how backed by years of practical problem solution experience in the plastics industry . . . an outstanding line of equipment . . . *PLUS* a cooperative testing laboratory with commercial size units.



GRANULATORS for continuous handling of film sheets (.001" to .003" thick, up to 48" wide) with better flow characteristics, and for scrap and sprues. All units precision-built to withstand severe duty.

RECLAIM SYSTEMS that include granulators, collecting units and pelleter or densifier—produce agglomerates suitable for compounders or molders.

PELLET MILLS for uniform densification of polyolefines, PVC resins and other thermoplastic materials. Available in stainless steel construction in a wide range of die sizes and operating speeds.



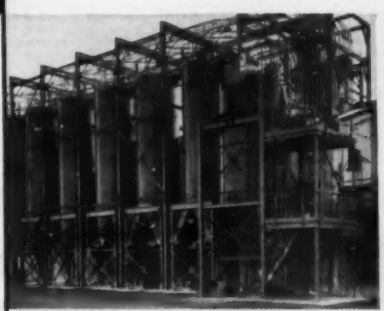
PRESSURIZED BULK TRUCKS that unload bulk cars; self-load, transport and convey granules or powders to storage without contamination from one load to another and without moisture pickup.

BULK HANDLING SYSTEMS — Pneumatic or mechanical, including air systems, elevators, conveyors and storage tanks—engineered to meet all types of requirements.

CRUSHERS—Easy to clean, rugged saw tooth type in a full range of sizes for light or heavy duty service.

SIFTERS — Boxless Gyro-Whip Sifters in a full range of sizes in stainless steel or wood construction. Efficient, easy to clean and space saving.

MIXERS for dry or semi-dry materials with or without heating or cooling jackets, of a proven design for maximum efficiency, trouble-free operation.



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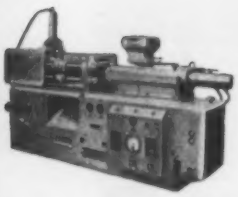
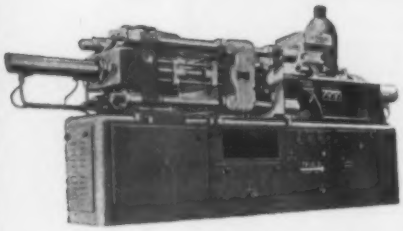
INJECTION MOULDING MACHINES



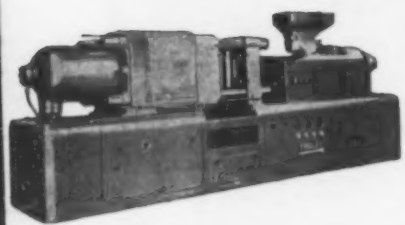
Mod. PLASTMATIC 30-40-80

- toggle clamping



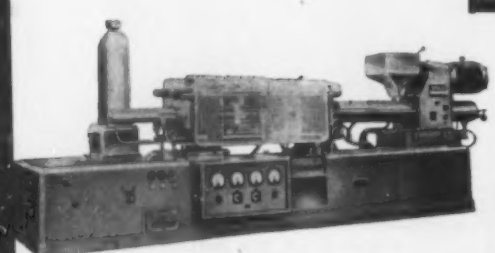
Mod. PLASTMATIC 140-170

- toggle clamping



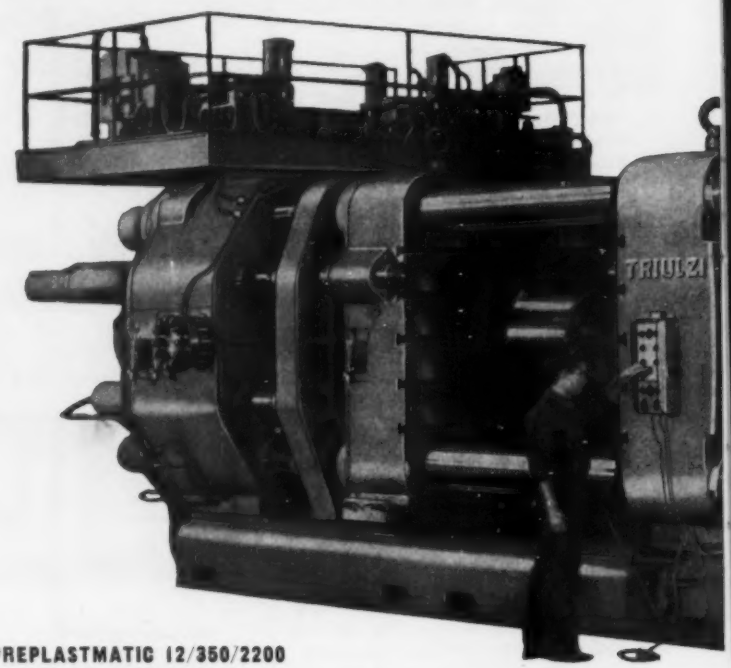
Mod. PLASTMATIC 200-350-800

- piston clamping



Mod. PREPLASTMATIC 300/40/150

- toggle clamping

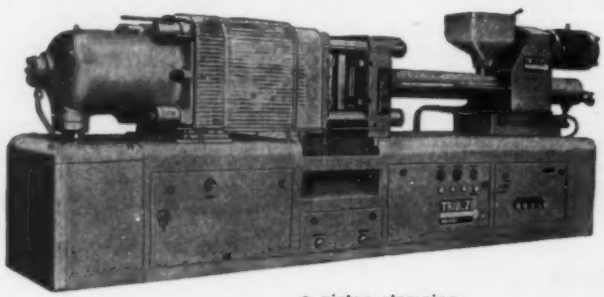


Mod. PREPLASTMATIC 12/350/2200

- fitted with screw preplasticizer
- *the biggest in the world!*

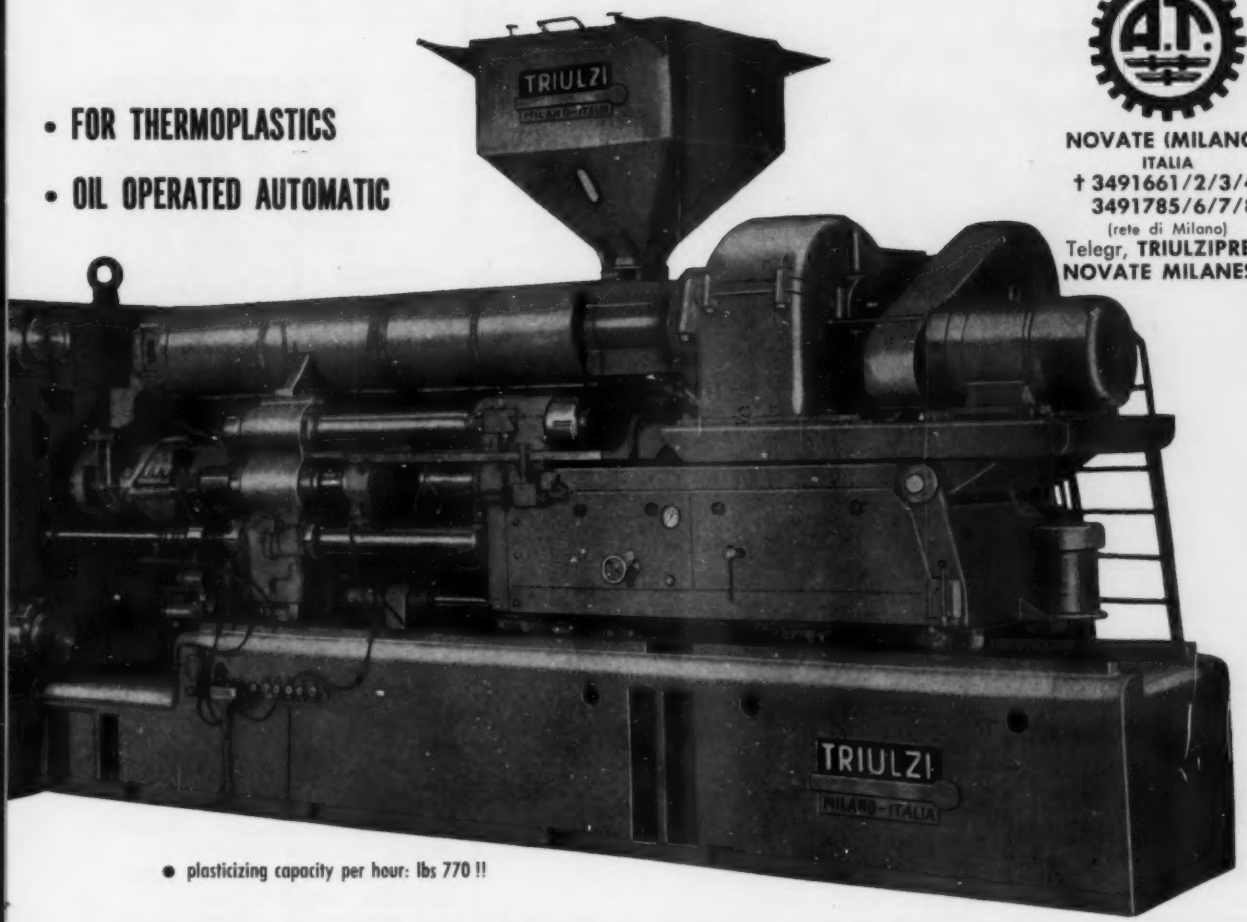
Some of our MODELS		PLASTMATIC					
		20/25	30/40	40/60	80/110	140/170	200/270
Maximum shot capacity (polystyrene)	gr.	20	30	40	80	140	200
	oz	3/4	1	1 3/5	3	5	7
Plasticizing capacity	Kg./h	6	7	9	12	18	31
	lbs./h	13	15	20	26	39	68 2/5
Mold locking force	T.	15	30	40	80	120	125
	U.S. tons.	16,5	33	45	90	135	140
Dry cycles per hour (compl. cycle)	N°	480	720	1200	740	360	300

Mod. PREPLASTMATIC 2/100/400 P



- piston clamping

- **FOR THERMOPLASTICS**
- **OIL OPERATED AUTOMATIC**



• plasticizing capacity per hour: lbs 770 !!

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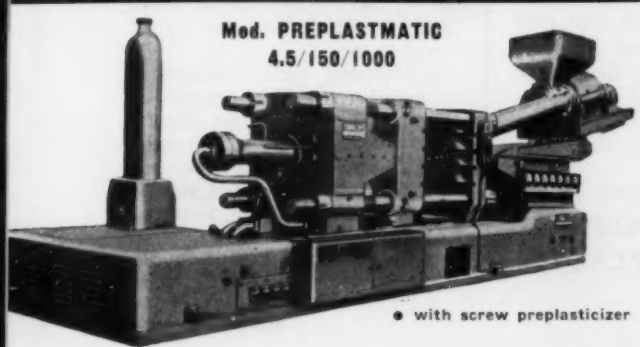
3491785/6/7/8
(rete di Milano)
Telegr, **TRIULZIPRES**
NOVATE MILANESE

		PREPLASTMATIC											
0/450	800/1000	160/20/80	275/40/125	300/40/150	600/40/280	1/100/300	2/100/400 P	2/100/500	2/100/700	4,5/150/1000	8/230/1300	12/350/2200	20/400/3000
350	800	160	275	300	600	1000	2000	2000	2000	4500	8000	12000	20000
12	28	6	10	11	21	35	70½	70½	70½	159	282	423	705½
37	55	20	40	40	40	100	100	100	100	150	230	350	400
81⅘	121	44	88	88	88	220	220	220	220	330	506	770	880
300	400	80	125	150	280	300	400	500	700	1000	1300	2200	3000
330	440	90	140	165	310	330	440	550	770	1100	1450	2420	3300
240	240	720	240÷660	420÷600	240	350÷600	240	360÷480	240÷420	240÷360	120÷180	60÷120	60÷120



Mod. PREPLASTMATIC 4.5/150/1000

• with screw preplasticizer

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to
TAKE A SECOND LOOK

. . . even at products which have long been considered "perfected".

The familiar crown cap, for example. Composition cork inserts have been used for nearly a century — more recently in combination with foil or coated paper. Now the advent of vinyl dispersions has brought about an exciting change in gasket design, and CHEM-O-SOL is playing an important part in it.

Dispensed into the crown shell as a liquid, CHEM-O-SOL takes shape under the light pressure of a metal die and fuses quickly with heat. Another version is uniformly distributed by centrifugal force and expands to a foam as it fuses. Less material does the same job, and it's applied in one operation instead of two. Sealing properties are excellent and delicate flavors are protected, too.

This is only one example. There are hundreds of other exciting possibilities for our CHEM-O-SOL coating, molding, and gasketing material. The CHEM-O-SOL brochure will help you to *take a second look* at your own products. Write Chemical Products Corporation, King Philip Road, East Providence, Rhode Island.

CP CHEM-O-SOL® THE MOST ADAPTABLE PLASTIC

THE PLASTISCOPE

(*From page 385*)

molded from high-density PE for handling 16 containers of milk. They are one-third the weight of customary wooden cases, resistant to rough handling, can be steam cleaned and stack efficiently. They might also be used for beer cans or perhaps even bottles. A similar large container was a long box-like item used for toting clusters of bananas from one location to another in grocery stores. These items are still on test in an effort to determine how much abuse they can take.

Selections for U. S. display at International Plastics Show

Sixteen plastics products for use in the home were named by a panel of industrial designers for inclusion in the U. S. Display at the 1961 International Plastics Exhibition, "Interplas '61," to be held at Olympia, London, June 21-July 1, it was announced by the Industrial Designers Institute. The exhibition is a biennial event organized by the publication, *British Plastics*. The 16 products were chosen as examples of good design in plastics from a wide variety of household and home furnishings entries by a Selection Committee composed of members from the Industrial Designers Institute and the American Society of Industrial Designers. The products selected for exhibit were:

1. Reinforced plastics dining chair, because of new use of polyester-glass laminate for structural purpose, manufactured by The Troy Sunshade Co., Troy, Ohio; designer, H. V. Thaden.

2. Cool-Mist humidifier, for bringing therapy to the home in a simple functional design, manufactured by John Oster Mfg. Co., Milwaukee, Wis.; designer, Alfred W. Madl.

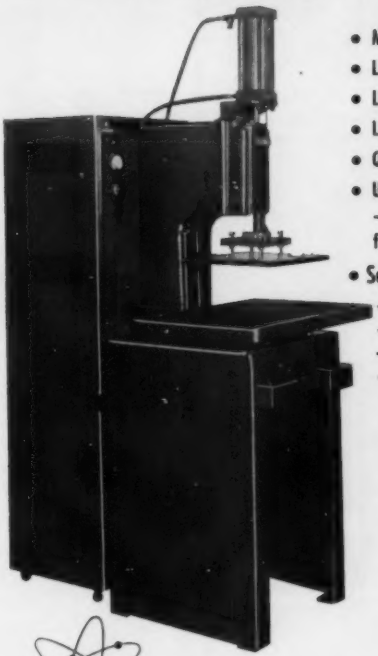
3. Flint cook and serve tools, for new use of decoration on melamine handles, manufactured by Ekco Products Co., Chicago, Ill.; designers, Latham-Tyler-Jensen.

4. Electric knife sharpener, because it was compact and esthetically pleasing, manufactured by Burgess Vibrocrafters Inc., Grayslake, Ill.; senior designer, Doug Anderson, Dave Chapman Inc.

5. Portable electric humidifier, for its clean and direct approach to design, manufactured by Burgess Vibrocrafters Inc.; senior designer, Doug Anderson, Dave Chapman Inc.

6. Deluxe line electric portable mixer, Countess (Golden Shield by Hamilton Beach), for its new concept of a popular item, manufac-

Kabar Electronic Heat Sealer



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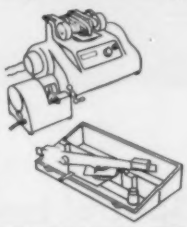
Because of its direct reading scale, the Taber stiffness tester can be operated by non-technical personnel. It features standardized test length, angle of deflection, graduation dial, and range weights to permit tests to be readily duplicated in laboratories throughout the world.

Detailed information on this device as well as other Taber testing instruments can be obtained by filling in and mailing the coupon below.



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Measures wear life (or abrasion resistance) of metals, plastics, paints, rubber, textiles, linoleum, etc. under simulated conditions of actual use.

SHEAR/SCRATCH TESTER MODEL 203

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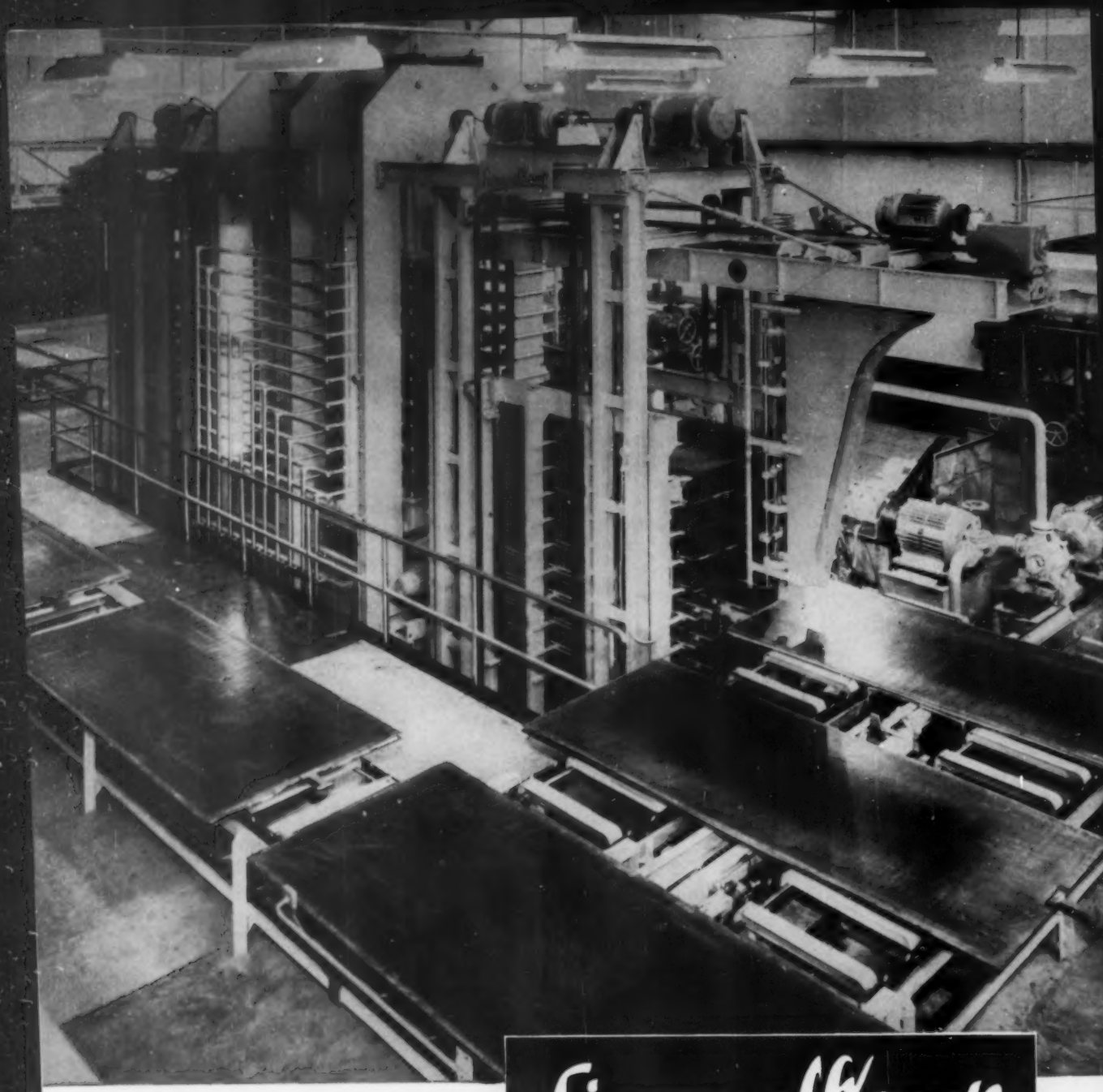

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for any pressure and temperature
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MOLDED FIBER GLASS BODY COMPANY

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THE PLASTISCOPE

(*From page 388*)

tured by Hamilton Beach Co., Racine, Wis.; senior designer, Robert Le Sueur, Dave Chapman Inc.

7. Baby gift set—Combination bottle warmer, vaporizer, and food warmer, because it was attractively designed and handsome, manufactured by Hankscraft Co., Reedsburg, Wis.; design team, Dave Chapman, Doug Anderson, John Davies, Dave Chapman Inc.

8. Electric Safe-T-Drill, for its excellent functional use of material, manufactured by Millers Falls Co., Greenfield, Mass.; designer, L. Garth Huxtable in collaboration with Millers Falls Co. Engineering Dept.

9. Chiffon liquid detergent plastic bottle, because it was well designed, functional, and easy to grasp, manufactured by Armour & Co.; designer, Dickens Inc., Robert Sidney Dickens, director, and Kenji Yoshizumi, designer.

10. U. S. Royal vinyl carpet, for its practicality, serviceability, and low maintenance qualities, manufactured by U.S. Rubber Co., Mishawaka, Ind.; design consultants, Harley Earl Associates, in conjunction with Division Development Labs.

11. Shampoo Master, for good design of a practical item, manufactured by Bissell Inc., Grand Rapids, Mich.; designers, P. W. Beuchler and C. A. Samhammer; Harley Earl Associates.

12. Argus Pre-Viewer, for its simplicity of design and practicality for home use, manufactured by Argus Cameras, Div. of Sylvania Products Inc., Ann Arbor, Mich.; designer, Harley Earl Associates, Fred Hertzler. Dominic A. Saporito, project head.

13. Dishdrainer, because a new concept of a familiar item produced a pleasing new form, supplied by Polymer Chemicals Div., W. R. Grace & Co. and manufactured by Columbus Molded Plastics, Columbus, Ohio; design team, Walter Dorwin Teague Jr., Ben Stansbury Jr., and Robert Blood; Walter Dorwin Teague Associates.

14. Washing machine wringer, for remarkable use of material resulting in a good solution to the problem, manufactured by Central Rubber & Steel Co., Findlay, Ohio; designer, Raymond Loewy/William Snaith Inc.

15. Melamine dinnerware, Boontonware, selected as a successful example of a classical form in a new material, manufactured by Boonton Molding Co., Boonton, N. J.; designer, Belle Kogan. **(To page 394)**

Visit Application Engineering Corp BOOTH 113, National Plastics Exposition, June 5-9, 1961, at the Coliseum, New York, New York.

MODEL WC—MODEL AC

INCREASE YOUR PRODUCTION 20% TO OVER 100% WITH MULTITEM WATER CHILLERS!

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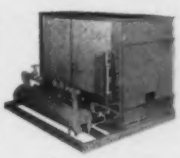

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HERCULES **Packaging Hi-Lites**

Modern polyolefins make handy, handsome packages

Functional, eye-catching, low-cost containers prove sales key to many markets

With self-service the modern king of marketing, the package now rules as the product's star salesman. Today's package must be more than a functional carrier or an eye-catching wrap. The *right* package is a complete merchandising tool: the base on which effective advertising is built; a container which reflects and protects product quality; an action-stimulating factor at the point of sale.

Packages made with modern polyolefins combine all these important features with another must: *low cost*. Both Hi-fax® high-density polyethylene and Pro-fax® polypropylene are now revolutionizing packaging concepts in such large volume markets as detergents, drugs, cosmetics and food, to mention just a few. They display the product right, protect it enroute to consumer, and help to close the sale—and all at a new low in packaging costs. Here's a look at some of today's exciting new packages, made possible by these new and better plastics designed to meet *modern* requirements.

The new SINGER Buttonholer package hinges on Pro-fax

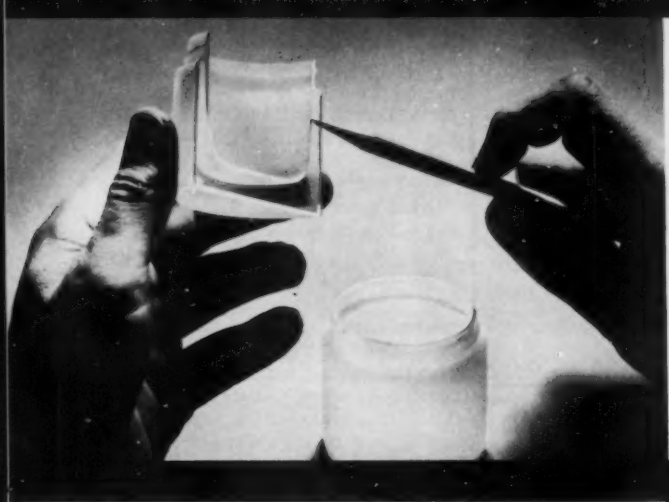
They've been sewing buttonholes in garments for more than five hundred years, but never with equipment like this. Singer Sewing Machine Company's ultra-modern buttonholer attachment is designed to make short work of this intricate, time-consuming job. It's packaged in tune with the times in a high-styled, durable, *permanent* package molded with Pro-fax. Box and lid are made in one piece, with an integrally molded hinge that grows stronger with use. Molded-in compartments hold all the interchangeable templates in the unit conveniently in place.

Molded by Consolidated Molded Products Company, Scranton, Pennsylvania, for Greist Manufacturing Company, New Haven, Connecticut.

Hi-fax handles drug products, too

Eli Lilly and Company led the way in introducing plastic bottles for dry products with these attractive, compact containers blow-molded with Hi-fax. One-fifth smaller than the glass bottle required to package an equal number of tablets, they are only one-tenth the weight of a glass container. Hi-fax bottles can be in the amber color traditional for pharmaceutical packaging, or in exciting modern pastels.

Blow-molded by Continental Can Company, Chicago, Ill.



Pro-fax handles cream products

This IMCO double-walled jar is made of Pro-fax . . . an unlined jar which is impermeable enough to hold most cream products. Molded to match the dimensions and capacity of standard flint and opal jars, it is five times lighter than flint, lighter still than opal. Color possibilities are unlimited, breakage practically eliminated, and shipping costs greatly reduced. Another *modern* solution to a tough packaging problem made possible by versatile Hercules polyolefins.

Manufactured and distributed by IMCO Container Corporation, Kansas City, Missouri

Hi-fax handles new design concepts

When your new packaging idea calls for new concepts in material performance, Hi-fax often provides the solution. Improvements in plastic container engineering techniques, coupled with the superior plastic properties provided by Hi-fax, make this outstanding new IMCO package for Mennen's *Brake* a powerful merchandising tool. Hi-fax can handle your new concepts in containers, whether they be for detergents, drugs, cosmetics or household chemicals.

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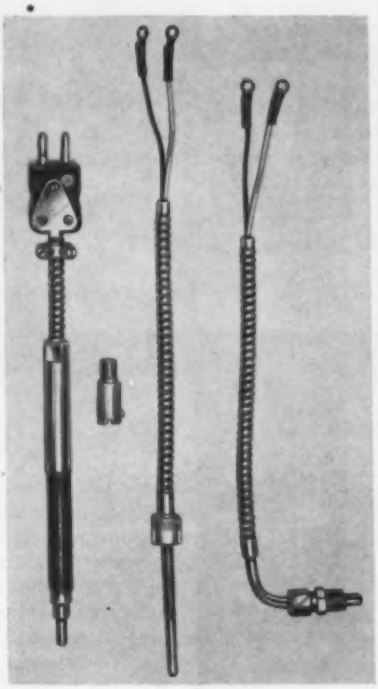

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THE PLASTISCOPE

(*From page 391*)

16. Wall lamp, for decorative and practical use of plastic, manufactured by Lightolier Inc., New York, N. Y.; designer, Carl Moser.

Midwest Technical investment in plastics

Midwest Technical Development Corp., Minneapolis, Minn., has invested $150,000 in Plasticon Corp., recently organized plastic manufacturing company.

Plasticon Corp. is headquartered in Minneapolis and operates a plant in Rock Island, Ill. The company is producing large containers and other plastic objects by blow molding. Typical products will be containers, ranging from 15- to 25-gal. capacity, for chemicals and other industrial and commercial purposes.

Buton resin in Japan

The Japanese claim to be equipped to produce 10 billion sq. ft. of vinyl chloride-steel laminates, says Donald F. Koenecke of Enjay Chemical Co., who recently returned from an inspection trip in Japan and the Philippines. Mr. Koenecke, whose principal interest for Enjay is in Buton (polymerized butadiene) coatings, states that, if this report is true, the 2-mil coating used on the underside of the steel would require 8½ million lb. of coating resin, which he hopes would be Buton. Note that the Japanese are concentrating on the laminate—apparently they have not yet gone heavily into the spread-coated-plastisol-on steel application.

Another comment from the speaker indicated a Japanese interest in Buton as the bonding agent for such inexpensive fillers as paper and asbestos to use in pipe transporting water, waste, as well as for hot-spring water transportation.

New vacuum coater

A new facility for the vacuum deposition of thin films has been formed at Huntingdon Valley, Pa. Known as Evaporated Coatings Inc., it is equipped with high vacuum evaporators and offers a complete line of standard coatings for optical control, conductive and solderable electrical films, bonding films, ultra-thin spacers, as well as a variety of thermal control films.

Special coatings can be engineered to specific requirements. Coatings can be applied to plastics and low-vapor-pressure plastics, glass, ceramics, and metal. It is applied to exteriors and precisely follows the pattern of the

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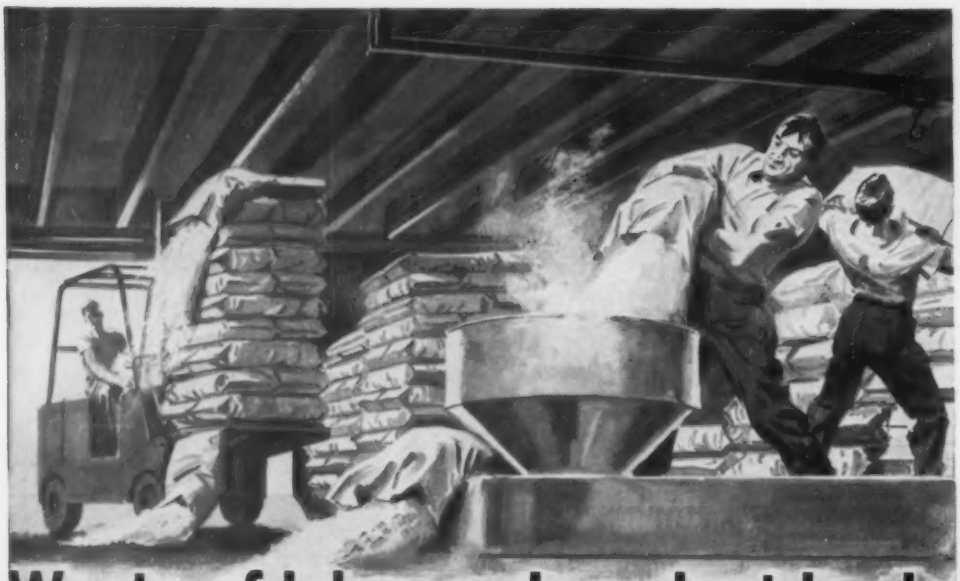

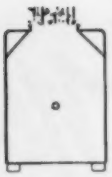

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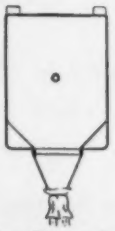

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Ideal for inter-plant or intra-plant these units are considered part of special rail car with "freight free" advantages. Due to the simplicity of design, maintenance of the Invert-a-bin* is nil.

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THE PLASTISCOPE

(*From page 394*)

coated object. Maximum size limitations are 48 by 48 inches, according to the company.

PE packaging for cranberries

Polyethylene bags, designed and produced by The Dobeckmun Co., a division of The Dow Chemical Co., are playing a role in a campaign by Ocean Spray Cranberries Inc. to promote cranberries as "the natural mate for every meat" on a year-round basis. In order to promote the "homemade" dishes, the company had to find a suitable flexible package for fresh cranberries for protection, appearance, transparency, and "feel" of the package. Polyethylene met the requirements. The fresh berries can be frozen in the package for future use, or kept under normal refrigeration for 5 or 6 weeks.

Campbell-Kent form assn.

A cooperative association of Campbell Machinery Development Co. and Kent Machine Co., both of Cuyahoga Falls, Ohio, has been formed to expedite the production of plastic and rubber processing machinery. Campbell-Kent will perform design, development, and manufacturing operations on equipment as required in the plastics and rubber industries. Designing and developing will be handled by Campbell Machinery, and sales of the machines will be by Kent Machine. Among several machines produced will be splitters for plastic and rigid foam products, V-belt manufacturing machines, etc.

Methacrylate wall paint

The answer to recently stepped-up capacity for production of methacrylate monomer is partially answered by Du Pont's announcement of a new Lucite wall paint. This newest paint is different from previous acrylic latexes produced by Du Pont and other companies in its thixotropic properties. The new paint is unusually thick—about like mayonnaise. Because of this heavy body, it does not drip, run, or spatter like regular paint, but it flows smoothly and rapidly. Du Pont points out that very little protection of surrounding area is necessary when this paint is being applied. Missed spots can be touched up at any time without showing. Small hairline cracks are bridged without the need of patching plaster. Its thickness makes it possible to do most of a ceiling while standing on the floor and using a roller. It is suitable for all **(To page 400)**

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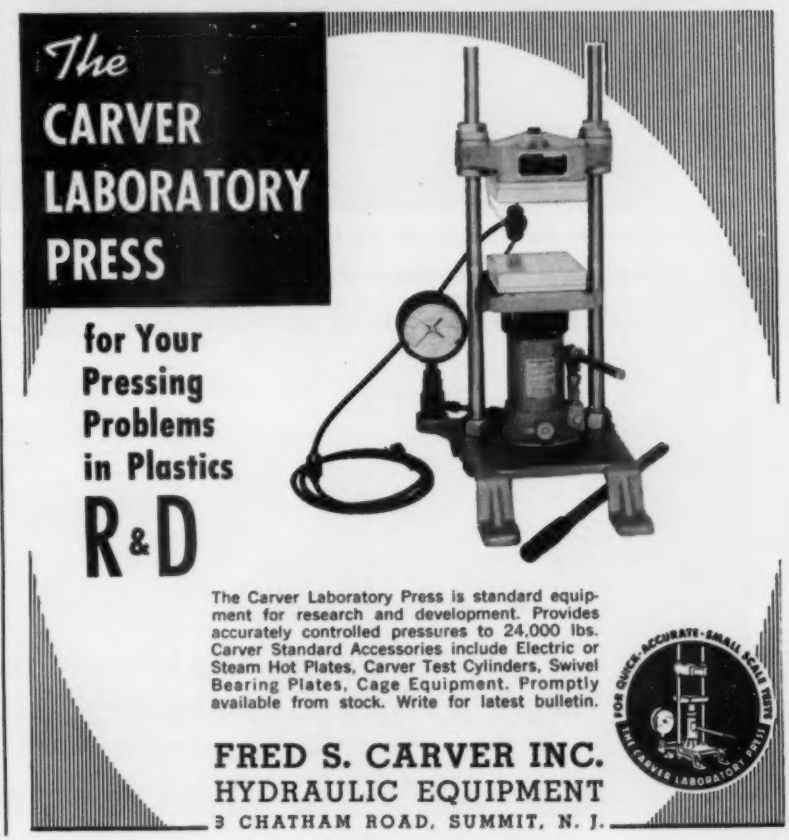
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MODEL	300-145	2414-6	3214-12	3220-125 (A)	3220-125 (B)	3624-18
Max. Capacity-oz. (conventional)	14	9	16	16	20	24
Max. Capacity-oz. (with 2nd stage)		30	32	50	50	50
Clamping stroke (inches)	6-14	6-14	8-14	8½-20	8½-20	8-24
Daylight opening (inches)	32	32	36	42	42	50
Clamping pressure (tons)	300	250	375	375	375	450
Maximum Mold Size (VXH)	16½ x 28	14⅞ x 28	20 x 36	20 x 36	20 x 36	23¾ x 38

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NEW COMPACT SMALL CAPACITY WEIGH-FEEDER

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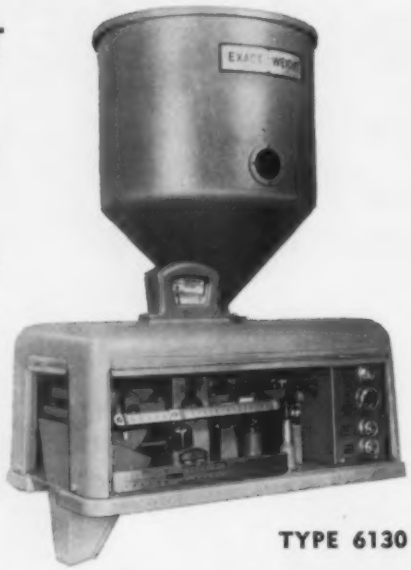

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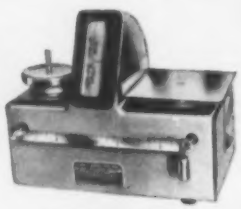
Improved quality of molded parts . . . savings of materials . . . speed-up of molding cycle . . . fewer rejects. Exact Weight Plastic Weigh-Feeders offer these and other important advantages. The precision industrial scale with over-and-under indication and precision controls provide extreme accuracy. Plunger Position Control is fully automatic, effective with either starve or cushion feeding. These machines are backed by more than 45 years of experience in designing and manufacturing industrial scales. Service facilities in all principal cities.



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THE PLASTISCOPE

(From page 397)

kinds of wall surfaces—plaster, wallpaper, paint, wallboard.

This is the last in a series of acrylic paints developed by Du Pont, which is among the pioneers in development of so-called water or latex paints, as distinguished from the older paints that use oil as a solvent or carrying agent for pigment. One of the earlier ones was the company's acrylic lacquer for automobiles which superseded nitrocellulose lacquer. About half the cars produced today use Lucite lacquer.

In 1959 two new applications were perfected. One was a factory-applied, baked-on acrylic finish for aluminum used for building exteriors. The second was a blister-resistant, more durable paint for exterior wood siding, which is used over previously unpainted wood.

Teslar is now Tedlar

The Du Pont Co. has announced that the term Tedlar is being substituted for the term Teslar as the trademark for its polyvinyl fluoride film. Use of the new trademark, which was adopted to avoid possible confusion with an already existing mark, is effective immediately.

Tedlar PVF film is a new product for industrial uses which has outstanding weather ability, toughness, chemical inertness, and electrical insulating properties. It is expected to be widely used in the construction industry as a laminate protective covering for wood and metal. Now in pilot plant production, it will be manufactured commercially in a new plant at Buffalo, N. Y., which is expected to start operations about the middle of 1962.

Fire-retardant laminate

Two new fire-retardant, cold punch copper clad laminates, paper-base phenolics of XXXPC grade—65MO5 and 65MO6—are announced by Westinghouse Electric Corp. Principal applications are expected to be in radio and television printed circuits. Grade 65MO5 is recommended for small circuits or miniaturization. It is said to have high bond strength and high solder resistance.

The 65MO6 laminate, claimed to be warp-free, is particularly recommended by Westinghouse for automatic fabrication processes that require close registration of holes and circuits. Its high impact is said to contribute reduced breakage during assembly and maintenance-free performance in use. High adhesion, high

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is now available in two grades:

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VC-260 (a PVC homopolymer) is being used at up to 50% of the resin content of plastisols to give lower viscosity, viscosity stability and lower cost without sacrificing physical properties or fusion rates. Highly successful applications of VC-260 include roto casting, slush molding, and reverse roll coating. Samples are available through your Borden technical representative, or write: The Borden Chemical Company, Thermoplastics Division, MP-51, 60 Elm Hill Ave., Leominster, Mass.

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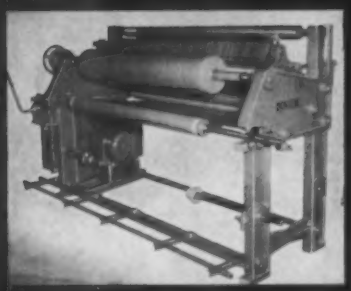

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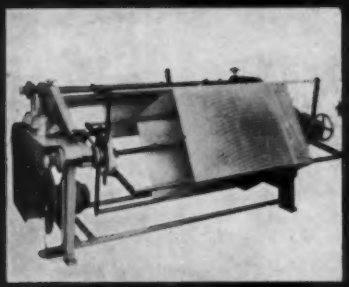
Available with variable or four-speed quick change drive.



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"Do you know of a manufacturer who . . . ?"

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Each month the Readers' Service Department of MODERN PLASTICS answers scores of questions for our readers. Questions range from simple requests for information about the manufacturer of a stock molded item to requests which must be referred to industry sources for action.

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If you have a question, feel free to forward it. There is no charge or obligation for this service. Address—Readers' Service Department, MODERN PLASTICS. A complete reply to your inquiry will be sent promptly.

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Write for complete information and price list.

Peterson Products

1325 Old County Road Belmont, Calif.

THE PLASTISCOPE

(*From page 400*)

insulation resistance, retained in humid conditions, and low moisture absorption are other characteristics claimed for the material.

Cold-proof polystyrene

Price of the new class of impact polystyrenes for injection molding introduced by Union Carbide was erroneously reported in this column last month as 26¢ per pound. The price is now 22¢—it was 26¢ when introduced last November. The material is characterized as medium impact, but is said to have higher strength and toughness even at —20° F. than does conventional medium-impact polystyrene.

Styrene-acrylonitrile copolymer announced

A reduction in prices and the development of a new formulation for its styrene-acrylonitrile copolymer family was recently announced by The Dow Chemical Co.

The price reduction amounts to 2½¢/lb. for crystal, standard, and special color formulations and 1½¢/lb. for Crystone (blue tint) formulations in truckload quantities.

The new formulation, trademarked Tyril 750, is a low acrylonitrile copolymer designed for applications where the chemical resistance of general-purpose polystyrene is insufficient, but the superior chemical resistance of regular formulations of Tyril is not needed.

Areas of application for Tyril 750 are expected to be packaging—especially dairy products—closures, batteries, and hair curlers. The new formulation can be recommended for food packaging applications under the Food Additives Amendment to the Federal Food, Drug and Cosmetics Act, according to a company spokesman.

Tyril 750 is said to provide improved molding characteristics, processability and clarity over Tyril 767 and Tyril 780. It is priced at 5½¢/lb. below these formulations, at 34¢/lb. for crystal in truckload quantities. It is available in crystal only. The new formulation is not recommended for applications where chemical resistance is critical.

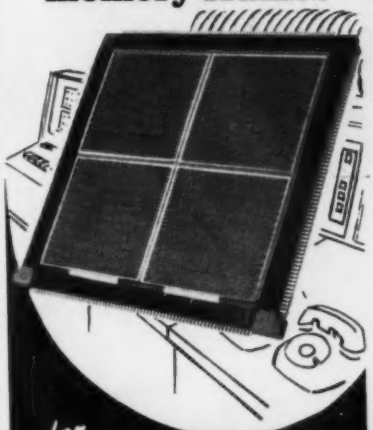
New PE film resin

A polyethylene film resin claimed to have 40% greater impact strength than general-purpose resins has been introduced by Monsanto Chemical Co. It will permit use of lighter gages to meet **(To page 406)**

example...

FIBERITE

at work in computer memory frames



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These frames hold and protect the tiny "memory units" which store information for processing.

IBM Poughkeepsie, working with Fiberite Corporation, specified a reinforced plastic frame material with these characteristics:

- The ultimate in dimensional stability under widely varying atmospheric conditions
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Binks Gel-Coat System is pretested . . . shipped completely assembled. Just four simple steps and you're ready to spray: 1. attach hoses; 2. add resin to tank; 3. dilute catalyst; 4. hookup hood respirator and set spray pressure.

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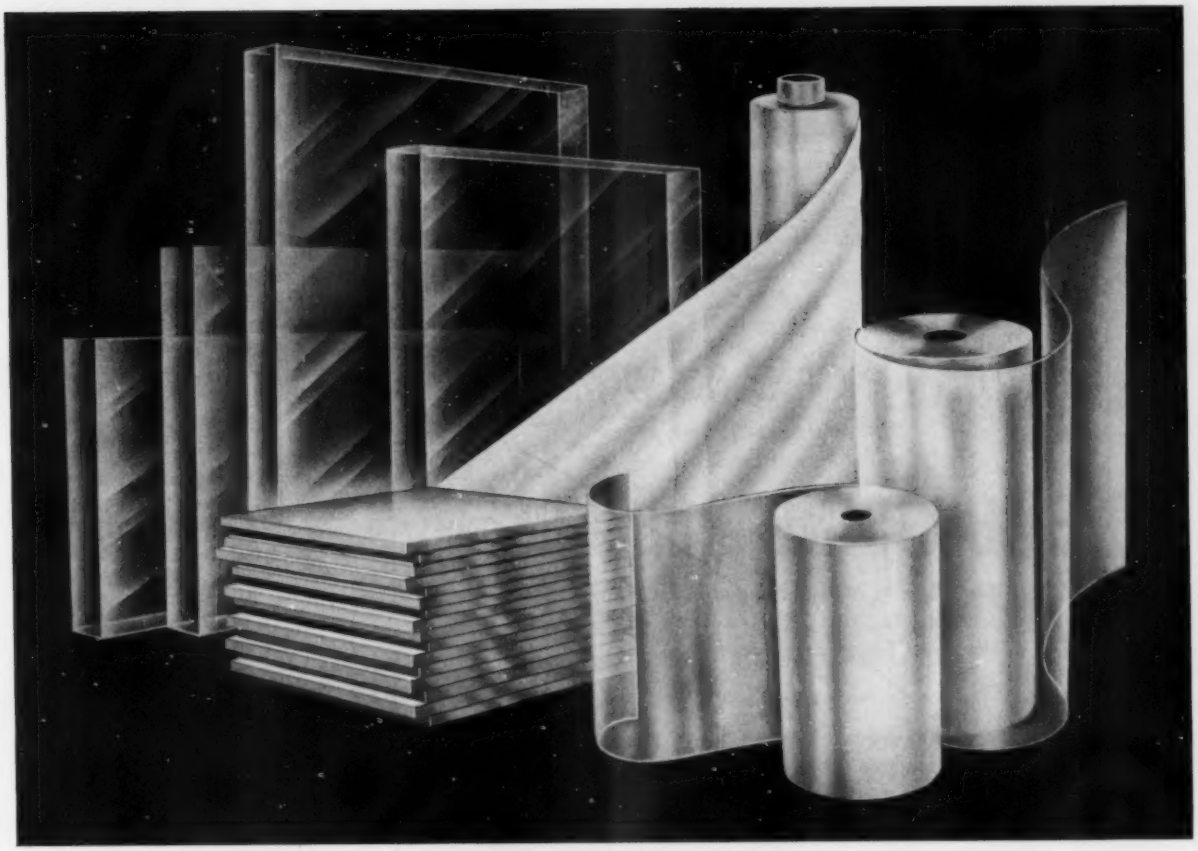

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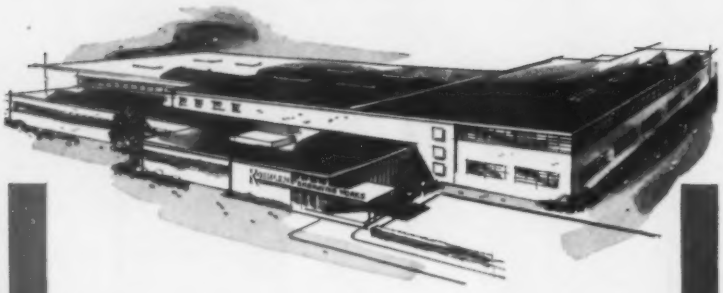
Prices are determined by quantity, thickness and sizes. Let us give you quotations on your requirements. Samples supplied on request.

	Film	Sheet	Slab	Rolls	Laminates
Vinylite (Rigid and Flexible)	X	X	X	X	X
Cellulose Acetate	X	X	X	X	X
Acetate Butyrate	X	X	X	X	X
Polystyrene	X	X	X	X	X
Plexiglas & Acetate with Embedments		X	X		
PVC		X	X	X	X
Polypropylene		X	X		
Polyethylene—Regular	X	X	X	X	X
Polyethylene—High Density		X	X		
Propionate		X	X		
Nylon		X	X		
Delrin		X	X		

Scranton Plastic Laminating corp.

3216-18 Pittston Avenue, Scranton 5, Pa.
Telephone Diamond 2-0407



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THE PLASTISCOPE

(*From page 403*)

toughness requirements, but there is no sacrifice in sealing range, the company states. If extruded at temperatures 10 to 15° F. above those used for general-purpose resins, there will be no loss in output, according to company spokemen.

The new resin is designed for 1- to 12-mil films used in industrial applications, such as vapor barriers, tarpaulins, temporary enclosures, shipping sacks, agricultural uses, and liners for drums, boxes, etc.

Interplastics Corp. and George Woloch Co. joined

A merger has been announced between Interplastics Corp., formerly located in Jackson Heights, N. Y., and George Woloch Co. Inc., New York, N. Y. The combined organization, suppliers of raw materials and molding powders, will do business under the name of George Woloch Co. Inc. George Woloch is president, and Harding Miller and Gerald F. Bamberger, vice presidents. The company has a branch office and warehouse in Akron, Ohio, manufacturing plants at Newark and Kearny, N. J., and warehouses throughout the United States. For foreign trade, branch offices are maintained in London and Paris.

Vinyl-coated tarpaulins

Twenty- by 40-ft. tarpaulins, made of a material called Bond-Cote by its manufacturer, Electro Plastics Fabrics Inc., Pulaski, Va., were used to keep heavy snows and rain off calcium chloride stored in bulk at Ohio Turnpike maintenance locations. Bond-Cote is nylon fabric coated with Geon vinyl, a product of B. F. Goodrich Chemical Co., Cleveland, Ohio.

The strength and flexibility of the nylon plus the waterproofing and protective characteristics of the Geon combined to keep the calcium chloride relatively moisture-free for periods as long as several months, the company states.

Marketing program for Xanfoam

General Box Co. and Thomas Plastikraft Corp. have been appointed converter-distributors of Xanfoam polystyrene foam by Sun Chemical's Dyna-Foam Division. Xanfoam combines such properties as thermal insulation, cushioning, water-proofness, grease-proofness, and non-abrasion. It can be readily formed, laminated, embossed, glued, heat sealed, and printed on (To page 410)

CADMIUM PIGMENTS

18

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Cadmium Lithopones

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Light Red	No. 80, 806
Medium Light Red	No. 90, 906
Medium Red	No. 100, 1006
Dark Red	No. 110, 1106
Maroon	No. 120

CADMIUM YELLOW PIGMENTS

Cadmium Lithopones

Primrose	No. 20, 206
Lemon	No. 30, 306
Golden	No. 40, 406
Dark Golden	No. —— 456
Orange	No. 50

(BOTH BLEED PROOF)

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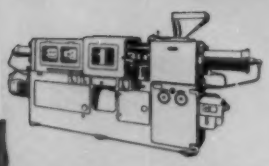

W15 Injection Moulding Machine

AP130
Injection Moulding Machine

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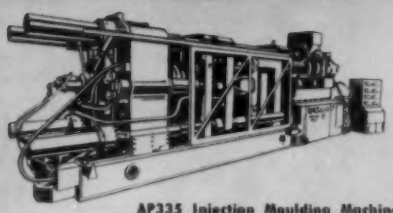
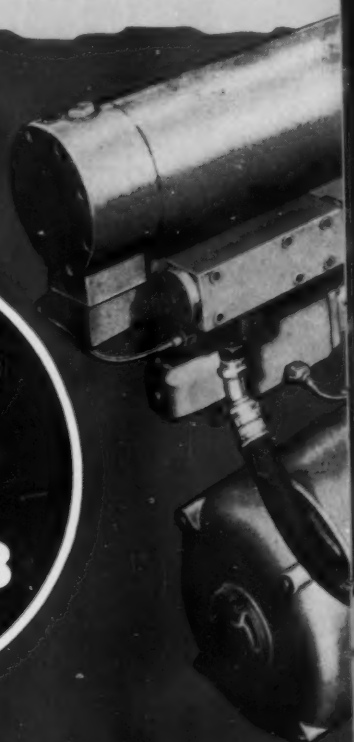


AP335 Injection Moulding Machine



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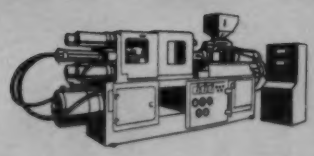
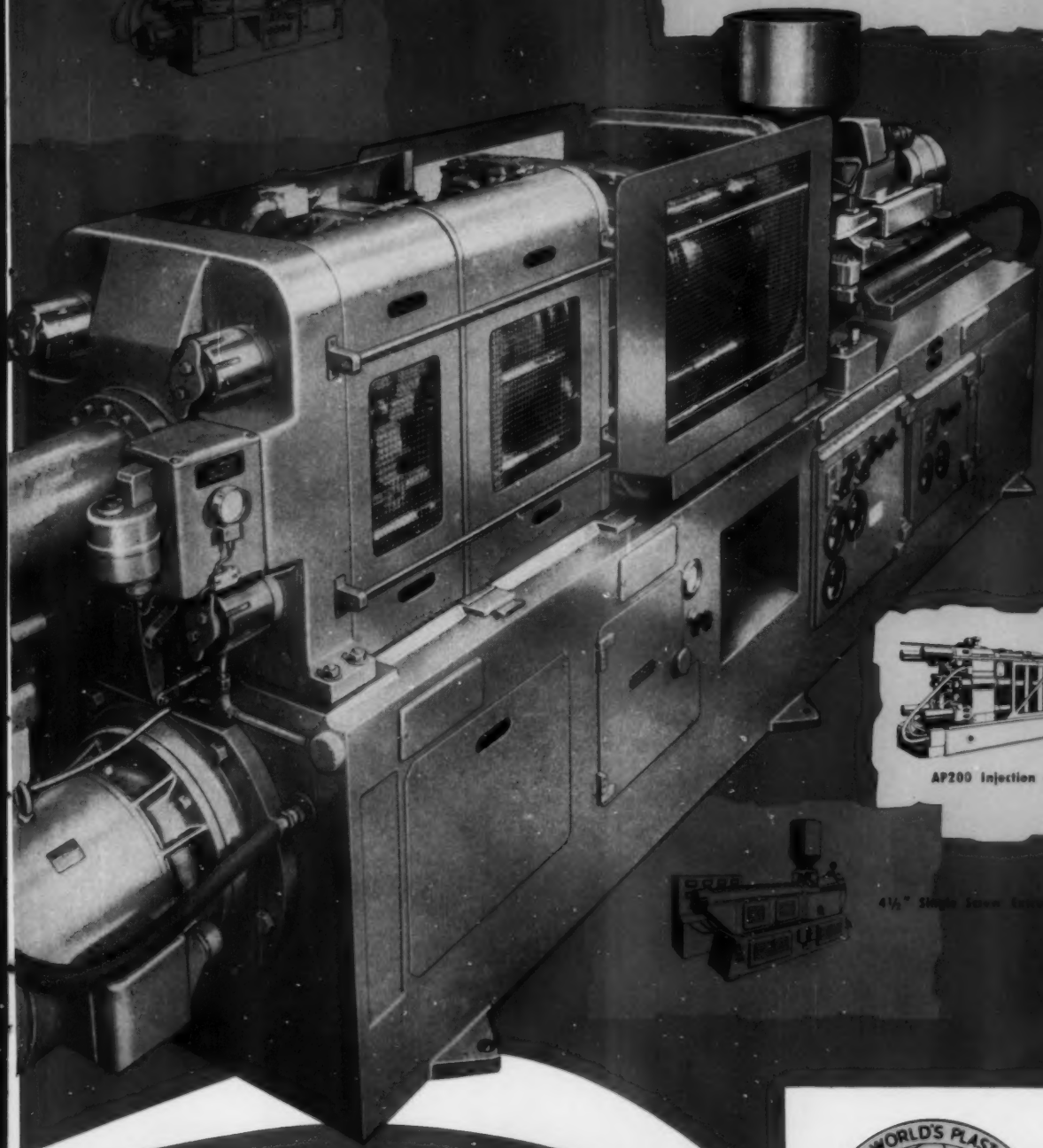
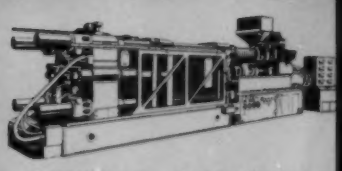


Moulding Machine





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THE PLASTISCOPE

(From page 406)

high speed automatic equipment, the company claims. It has already been made into cushioning platforms, bags, folding cartons, and has been used as set-up box covering and gift-wrap.

General Box Co. will initially set up production units in its existing facilities at Des Plains, Ill.; Detroit, Mich.; St. Louis, Mo.; and Denville, N. J. Eventually, it hopes to have such units operating in each of its 17 plants stretching from Texas to Massachusetts. Thomas Plastikraft Corp. will cover upstate New York. In the near future it expects to extend coverage to New England and Northern Pennsylvania.

This is beginning a program to establish converter-distributors throughout the U. S. and Canada.

Reinforced phenolic

An asbestos fiber-reinforced phenolic molding material with high heat resistance has been developed by Rogers Corp., Rogers, Conn., for use in brake applications. Called RL 415, the material, produced by the beater-addition method for homogeneous blending of fiber and resin, is easily molded into flat or three-dimensional shapes. It is claimed to have successfully replaced fabricated laminate for textile brake pads with spindles rotating at 20,000 r.p.m. at a torque of 20 in. per ounce.

Refrigeration pipe insulation

A series of molds which can produce foamed plastic pipe covering in practically the entire range of sizes and wall thicknesses required in dairies and cold storage plants has been developed by Pelafoam Inc., Berkeley, Calif. As many as several hundred combinations of size and wall thicknesses may be required from ¼ to 20 in., with wall thicknesses of from ½ to 10 inches. Pelafoam has developed this stock of plastic molds for making fitted pipe insulation from Dylite expandable polystyrene, a product of Koppers Co. Inc.

New lines for Commercial

Shapes made from MC Nylon 901, a formulation widely used as a bearing material in wear plates, in tooling, and in fixtures (because of its unique mechanical and structural properties): and from polypropylene, recently were added to the lines of plastics materials regularly carried and stocked by Commercial Plastics & Supply Corp., New York, N. Y.

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a new, high purity fluorescent brightener for plastics, coatings, synthetic fibers and other organic materials. Tinopal SFG has superior stability to light, heat, polymerization and curing conditions.

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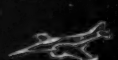

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THE PLASTISCOPE

(*From page 410*)

nylons but available at significant reductions in cost, MC Nylon now is competitive with continuous cast bronze bushings of similar size. It can be worked on standard machine tools, with large or small quantities able to be produced with equal economy. It is available in tubular bar, plate, or slab and rod.

Commercial's full line of polypropylene sheets and rods will start at 0.060-in. up to 1-in. thick. Sheet sizes, for the time being, will run 36 by 60 inches.

Fluorocarbons

Molded Teflon bellows. Precision studies of a hydrogen-fluorine flame, a fuel mixture with perhaps the highest temperature and greatest reactivity of any chemical system have been made possible by the installation of bellows molded of Teflon to damp out pumping vibrations in the system and permit measurements in fractions of a millimeter, according to Resistoflex, Roseland, N. J.

As first set up, the original apparatus had a vacuum pump on the exhaust side of a Monel vacuum chamber with a connection via a U-shaped section of 4-in. Monel pipe. Requirements were for operation at absolute pressures as 1 mm. Hg. and gas flows of a few cubic feet per minute. Vacuum pump vibrations however, caused the flame on the burner slot to waver.

As a vibration damper, a bellows of Fluoroflex Teflon was selected, rather than metal, because it would resist the action of hydrofluoric acid and fluorine gas at low pressure, and also for its long cycle life and ability to maintain a high vacuum, the company claims.

Spring loaded Teflon seal. A new line of spring loaded Teflon pressure seals for cryogenic, fuel oil, gas, and chemical applications has been developed by Raco Engineering, Santa Monica, Calif. The new standard flange seals feature a stainless steel spring insert, which acts as a compensating pressure on the Teflon seal in temperatures ranging from —420 F. to +500° F. The spring insert is said to provide initial sealing at zero pressures. As pressure increases sealing force increases. The spring also compensates for dimensional changes resulting from tolerance variations, thermal expansion or contraction, and cold flow of the plastic. **(To page 416)**

NEW!

Compact Control Unit Maintains Correct Injection Mold Temperatures

Here's a complete temperature control package for plastic injection molding machines. Simple to hook up, Mokon circulates water through the mold, heating and cooling it as required . . . **automatically!** Modulating control keeps the temperature of water entering the mold from varying less than ½° F. It takes but a minute or two to change from one water temperature to another. A unique pumping system supplies high velocity, high volume water with an extremely low total volume of water in the system. Two dial thermometers permit operating efficiency to be checked at a glance. Small in size and light in weight, Mokon can be readily moved from machine to machine.

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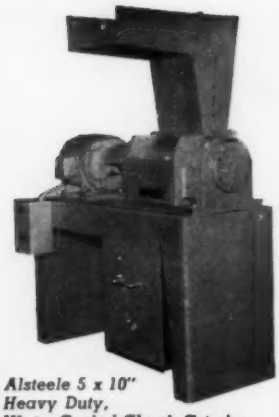
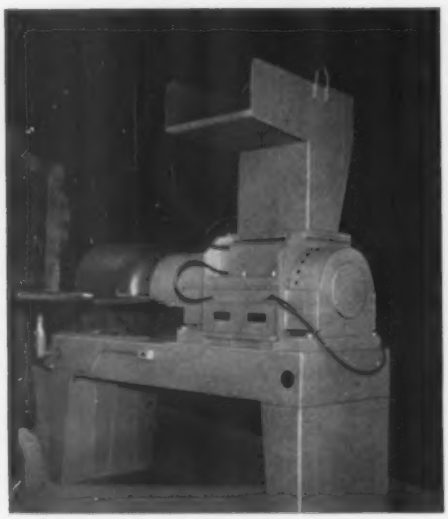
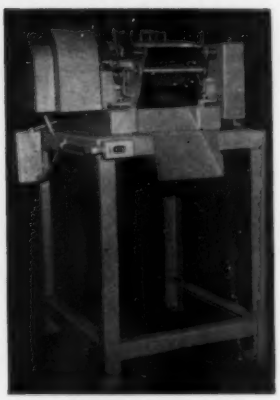


Alsteele 5 x 10" Heavy Duty, Water-Cooled Chunk Grinder



Alsteele Granulator: 100-150-200 HP

Alsteele Granulator, Model 24 x 36, for grinding very large molded parts without prior cutting. Several models in this series can granulate entire refrigerated door liners. Available in sizes 12 x 24", 12 x 36", 12 x 48", 12 x 60", 24 x 36", or larger



Hi-Speed Pelletizers to handle entire extruder output.

Beside-the-Press Granulators in a complete range of sizes.

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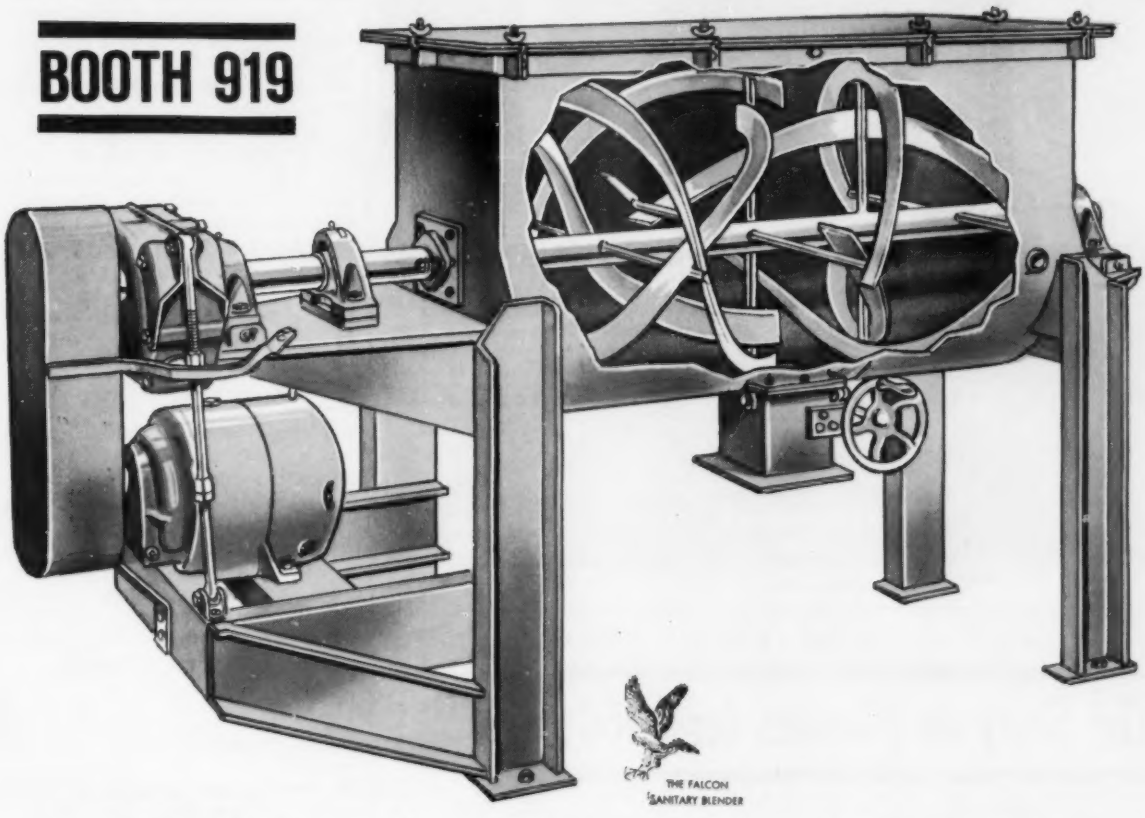
BOOTH 919



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This illustrated, 48-page reprint —in booklet form—offers a full discussion of 14 specific plastics materials; including polyethylene, polypropylene and vinyl chloride.

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THE PLASTISCOPE

(*From page 413*)

Large sizes of Teflon sheet. Sheet forms of Teflon TFE-fluorocarbon resin up to 8-in. thick and 25-in. square are now available from The Polymer Corp., Reading, Pa. Teflon sheet was previously supplied by Polymer in sizes up to 2-in. thick and 12-in. square sections, and the largest known sheet previously on the market has been reported to be of 3-in. thickness.

The sheets are designed to provide fabricating savings and new design possibilities in the electrical, chemical, and mechanical industries. Production of the new sizes will begin immediately in facilities recently engineered for this purpose.

Hollow Teflon balls. Hollow spheres of virgin TFE fluorocarbon resins provide a high degree of flotation, according to Chemplast Inc., East Newark, N. J. A 4-in. diameter size ball weighs only 6 oz., but will support a weight of more than ¾ lb. in water, the company claims. Said to be unaffected by all solvents and virtually all known chemicals at temperatures ranging from —350 to +500° F., a ready market is indicated for flow meters, float valves, and float level indicators in tanks storing corrosive fluids. Sizes range from 20 to 100 mm. in diameter.

Polyethylene

PE magazine mailing pouch. A new packaging technique for magazines and newspapers has passed a six-month trial period with the approval of a panel of communications experts, the 12,000 subscribers to the *Journal of Marketing*.

The magazine is mailed in a transparent, heat-sealed polyethylene pouch. Pressure-sensitive labels are applied to the sealed pouches to carry subscribers' mailing addresses. The *Journal of Marketing* claims to be the first publication mailed through the Chicago Post Office to use this packaging. The Sunday *New York Times* air mail edition and *Sunset Magazine* in the West have also adopted it.

Dr. Steuart Henderson Britt, editor of the *Journal of Marketing*, said the pouch packaging method offers two valuable benefits over conventional magazine mailing packages: Thorough protection for the magazine during handling in the mails, and see-through visibility.

The *Journal* has its table of con-

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. . . highly effective wet-out with polyesters, phenolics and epoxies in producing translucent products with high unidirectional strength.

520 Roving . . . for spray-up applications

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508 Roving . . . for preform molding

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Chopped Strand Mat . . . for sheets, boats, high pressure molding

. . . wets out faster than ordinary mat, has uniform fiber distribution; provides improved strength, appearance and workability; pure whiteness eliminates discoloration.

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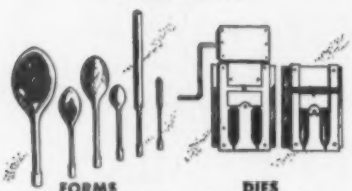
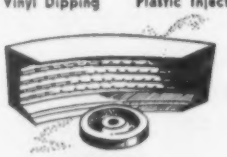


FORMS
Latex & Vinyl Dipping

DIES
Plastic Injection



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In the Heart of the Rubber & Plastics Industry

THE PLASTISCOPE

(From page 416)

tents printed on the cover, and it has been found that, with the transparent pouch, reader interest builds up for the issue even before the mailing pouch is opened.

Service Printer Inc., Chicago, Ill., worked with film, bagging machine, and label paper suppliers in developing the system. Magazines are inserted and sealed in film pouches by machine, then the label is affixed, also by machine. Dr. Britt has indicated that the system has now been adopted on a permanent basis. The *Journal of Marketing* is the official publication of the American Marketing Association.

Linear PE heavy-duty bags. Rugged, flexible, economical bags, designed for the nation's growing nursery industry, have been introduced by the Crystal-X Corp., Lenni Mills, Pa., in 5-lb. size for grass seed, "5-10-5" fertilizer, or oak leaf mold; in 10-lb. units for bone meal, grass seed, or African violet soil; and in a 25-lb. size for fertilizers, African violet soil, and small quantities of peat moss. Minimum orders on these units are for 3000 bags, priced at 3¢, 4¢, and 6¢, respectively. Crystal-X imprints the nursery's name on each bag, even for small quantity orders.

The industry has its heart set on developing heavy duty PE bags as a major outlet for linear film or sheet. The potential market is in the hundreds of millions of pounds. There have been many starts and stops in development of a bag that will serve as a satisfying carrier with good barrier properties, and easy handling at low cost. This entrance into the nursery field is a good omen of progress for the future.

Frozen steaks in PE film. High-speed automatic wrapping of specialty steaks in polyethylene film is claimed to have increased sales 50% for Table Supply Meat Co., Omaha, Neb., according to information released by U. S. Industrial Chemicals Co., which states that its resin, Petrothene 112, is used for the job.

The company, a hotel and restaurant purveyor and marketer of specialty cuts of meat, uses the Mehl Manufacturing Co.'s one-step See-Safe Model MA packaging machine to build a polyethylene bag around each steak. The bag is then shrunk in an auxiliary heat tunnel unit for closer conformity to the steak's particular size and shape.

The poly-wrapped steaks are frozen,

ATLAS
Xenon Arc
Weather-Ometer®
and
Fade-Ometer®

A high pressure Xenon Arc with a spectral radiation distribution very close to that of sunlight is now available in the Weather-Ometer and Fade-Ometer.

This new Xenon light source is a 6000 watt water cooled lamp which at a sample distance of 18 7/8 inches produces a rate of deterioration equal to that of noon June sunlight.

Both machines have automatic control of black panel temperature, cycles, etc. and are available with automatic control of humidity.

The Xenon lamp is available with constant wattage transformers to insure a uniform radiation intensity regardless of variation in line voltage and controls are provided for increasing the wattage to compensate for loss of intensity due to lamp aging. Anticipated useful lamp life is 2000 hours. Lamp burner tube is easily replaceable by the operator.

Xenon Weather-Ometer®
$3457.00 up

A new testing machine for fast determination of the weathering qualities of plastic products. Fully automatic operation. Sample capacity 54 specimens 3" x 9" in size. Weather-Ometers manufactured after 1953 can be converted from carbon arc to Xenon arc.

Xenon Fade-Ometer® $3247.00 up

For testing color fastness or light aging of plastic products. Fully automatic. Sample capacity 140 specimens 2¾ x 4¾ or 70 specimens 2¾ x 8 inches.

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- Acetobutyrat
- Interpolymers
- Wax

of
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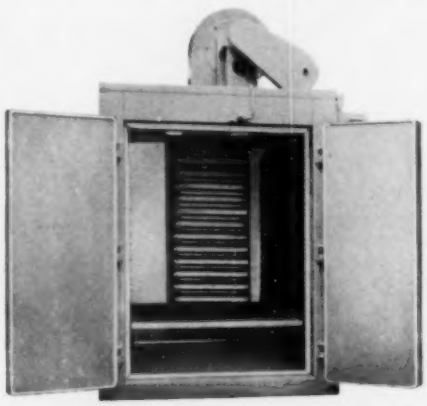

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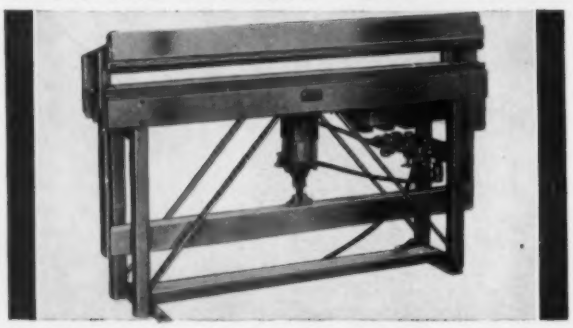

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This new complete line of pneumatically powered all steel Thermal Impulse Sealers are specially designed for welding Polyurethane Foam. Already in use by many foam manufacturers, processors and laminators they produce a pencil line thin trim seal that quickly develops to the full strength of the material. Catalogued units splice pieces up to 84" wide and ¼" thick. Larger machines are available on special order.

Vertrod Thermal Impulse Sealers are manufactured under one or more of the following U. S. patents: 2,460,460; 2,479,375; 2,509,439; 2,574,094; 2,574,095; 2,630,926; 2,633,442; 2,640,796; 2,640,798; 2,650,183; 2,675,854; 2,682,294. Canadian Patents 468,140 and 496,237. Other Patents Pending.

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Vertrod Corp.
THERMAL IMPULSE HEAT SEALING MACHINERY
3037 Utica Avenue, Brooklyn 34, N. Y.

(*From page 418*)

then packed in cartons, and shipped throughout the United States, Canada, and England.

Before installing See-Safe equipment and film, the company packaged with cellophane in a manual operation. The company states that costs have been cut in half by going to polyethylene. The new equipment wraps about 30 pieces a minute, as compared with about eight a minute wrapped in the old cellophane operation. The new wrapping machine is said to occupy only 10 sq. ft. of floor space.

New companies

Custom Materials Inc., 279 Billerica Rd., Chelmsford, Mass., has been formed for the manufacture of isotropic dielectrics and conductive plastics. Founders of the company are **Ralph Mondano,** president; **Al Simon** and **Ralph Pratt,** all formerly with Raytheon Corp.

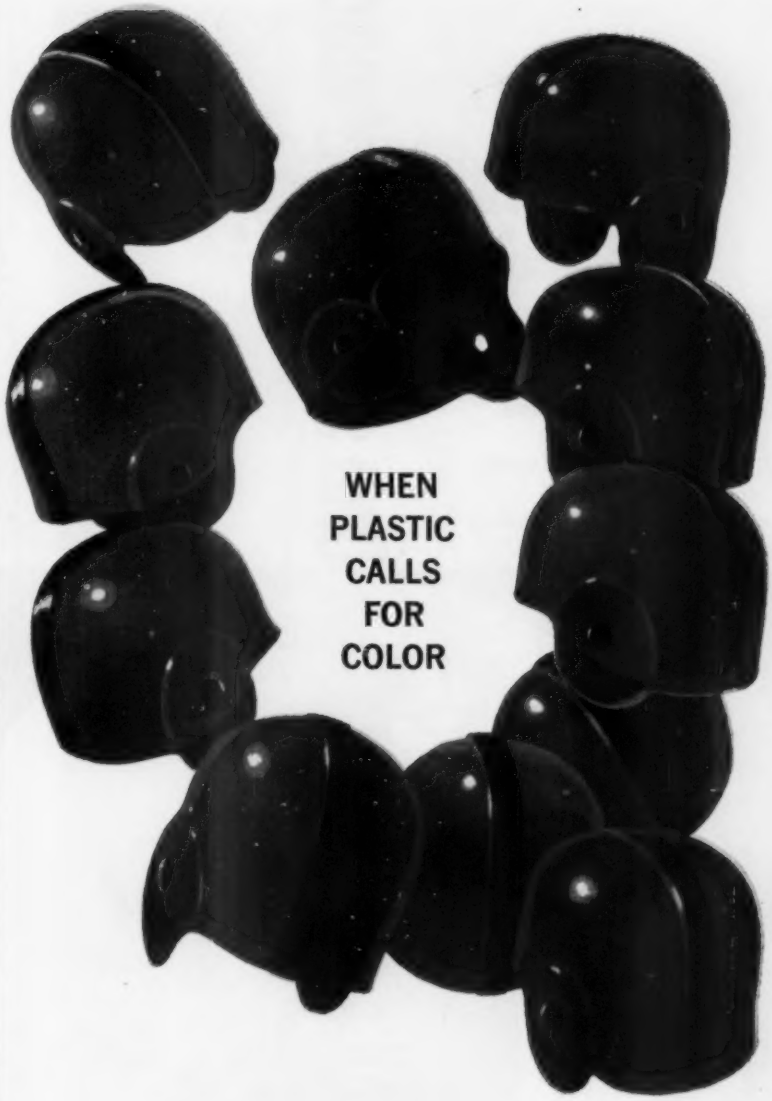
Construction Plastics Corp., 711 Cybus Way, Southampton, Pa., is a new company which specializes in the application of thermosetting foams and coatings, particularly in industrial building construction, remodeling, and maintenance. The materials will be produced chemically from a mobile unit and dispensed by spray or pour-in-place techniques.

Plas-Tech Inc., 1821 University Ave., St. Paul, Minn., has been formed as a custom molder of expandable polystyrene. **Robert I. Janssen** is president of the new company.

Expansion

General Electric Co., Pittsfield, Mass., is constructing a $500,000 polycarbonate product and process development laboratory at Mt. Vernon, Ind. The new facilities will allow for increased developmental effort on new Lexan copolymers, elastomers, and films, and will permit conversion of the present pilot plant facilities at Pittsfield to full-time product development activity.

General Electric will also make a $750,000 expansion in its phenolic molding compound plant in Pittsfield to increase plant capacity some 30 percent. Installation of new equipment will begin late this year and will be operational in 1962. General Electric's last major investments in its



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(*From page 421*)

phenolic compound plant were made in 1955 and 1957. Equipment installed in these projects at that time has been used at full or nearly full capacity in the past two years.

Amos-Thompson Corp., Edinburg, Ind., has added almost 19,000 sq. ft. of floor space for the Molded Plastics Division. Finishing facilities will be increased and the vacuum metallizing capacity of the plant will be doubled. Two independently controlled gas-fired ovens that will be conveyorized for automatic handling of production parts will be used in conjunction with two **F. J. Stokes Corp.** 72-in. vacuum plating chambers.

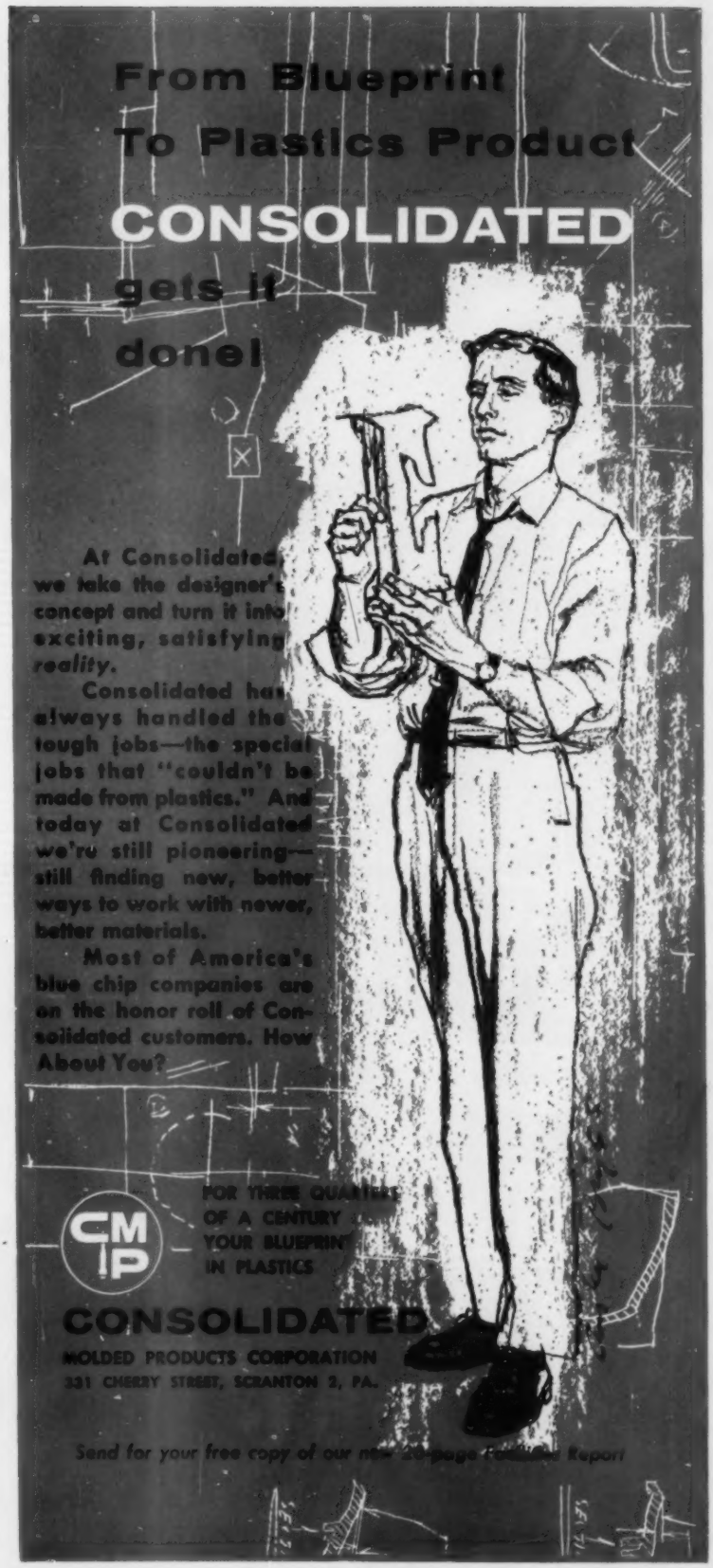
Imperial Chemical Industries Ltd., Millbank, London, England, is constructing a new polyvinyl chloride plant at its Hillhouse Works near Blackpool. This will raise its manufacturing capacity of PVC from the present 80,000 tons a year to approximately 115,000 tons a year by the beginning of 1963.

I.C.I. has also officially opened a new plant for manufacturing Melinex polyester film at Dumfries, Scotland. The plant has an annual production capacity of over 2000 tons, and currently employs 156 people, with an anticipated increase in personnel to 210 by the end of the year, according to the company.

The Heavy Organic Chemicals Div. of I.C.I. is also constructing a maleic anhydride plant at the company's Wilton Works. The plant will have a capacity of approximately 10,000 tons a year when fully developed. A new process will be used in which butene is oxidized with air.

In a further expansion move I.C.I. is building a plant on the north bank of the River Tees capable of distilling about 1 million tons of crude oil annually. Under terms of an agreement, **Shell-Mex** and **B. P. Ltd.** will make available to I.C.I. the crude oil for processing. The plant will consist essentially of a distillation unit to permit a variety of crudes to be processed and to vary the end products. The light distillate (naphtha) produced will provide a proportion of the feedstock requirements for the Division's three olefin plants at Wilton. Other products that are to be developed will be marketed by Shell-Mex and B. P. Ltd.

Strux Div., Aircraft Specialties Co., Inc., Hicksville, N. Y., has increased production facilities **(To page 427)**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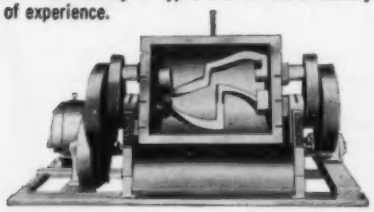

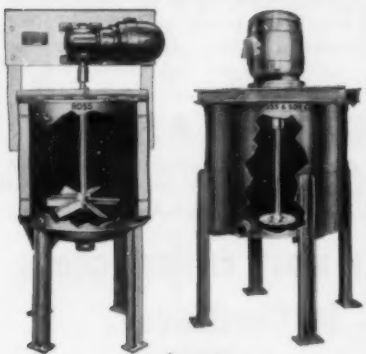

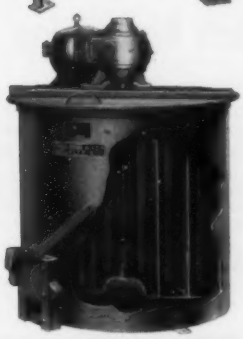

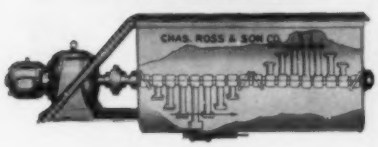

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THE PLASTISCOPE

(*From page 423*)

for rigid polyurethane foam. Automatic metering and mixing equipment is now in operation to produce boards, slabstock, and special molded shapes under the trademark of Ascofoam. Densities offered are in the range from 2 to 30 lb./cu. foot.

Southbridge Plastic Products Inc., Southbridge, Mass., has completed negotiations for the building of a new multimillion-dollar vinyl plastics plant in Corinth, Miss.

Vector Plastics Corp. has acquired **Fairchild Plastics,** Copiague, N. Y., formerly a branch of Fairchild Engine & Aircraft Corp. Vector will retain all key personnel, and will continue in the design of RP for both the military and industry.

Lock Joint Pipe Co., East Orange, N. J., has acquired **Corroplast Inc.,** Passaic, N. J., in an exchange of stock. Corroplast is an extruder of rigid PVC pipe, sheet, rod, and shapes. The new acquisition, which will operate as a wholly-owned subsidiary, is the second company to be brought into Lock Joint Pipe's recently formed Plastics Division. Electro Chemical Engineering & Mfg. Co., Emmaus, Pa. manufacturer of corrosion resistant construction materials in the form of coatings, linings, and adhesives, was acquired by Lock Joint earlier this year.

Lunn Laminates Inc., molder of reinforced plastics, has taken over the assets of **John Kaiser Associates,** Wilmington, Del., developer of a new 30-ft. ketch, Seawind, the first made of reinforced plastics materials. This announcement comes almost immediately after Lunn's acquisition of **Mariner Laminates Inc.,** designer and molder of U. S. Coast Guard-approved RP lifeboats, life rafts, etc.

Filon Plastics Corp., Hawthorne, Calif., has opened a new Midwestern Div. headquarters at Skokie, Ill. Located on a 1-acre site, the 12,000-sq.-ft., $150,000 warehouse and sales office building stocks over 1 million sq. ft. of paneling.

Shell Chemical Co. has selected three firms to design and build its multimillion-dollar polypropylene plastics plant near Woodbury, N. J.

C. F. Braun & Co., Alhambra, Calif., will engineer and erect the process units. **Catalytic Construction**

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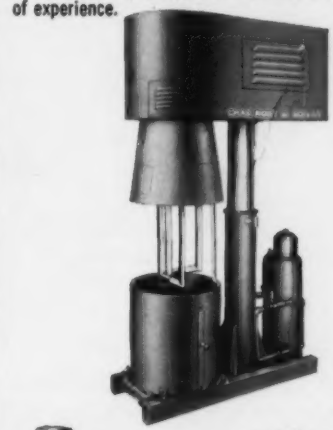

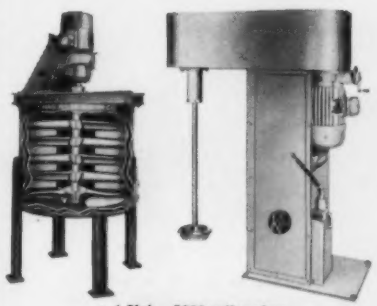

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THE PLASTISCOPE

(*From page 427*)

Co., Philadelphia, Pa., will construct the utilities and maintenance facilities. **The Ballinger Co.,** also of Philadelphia, has been selected as architect for the administration building and will also design the research and technical services laboratory.

Construction is expected to begin before the end of May, and the plant is scheduled to go into operation in the summer of 1962. The plant is designed to produce 80 million lb. of polypropylene a year.

American Cyanamid Co. and **Wasco Chemical Co. Inc.,** Cambridge, Mass., have signed an agreement for Cyanamid to purchase Wasco, manufacturer and distributor of cast plastic products for the construction industry. The agreement calls for the exchange of Cyanamid common stock for substantially the entire business and assets of Wasco, including the stock of its subsidiaries. Wasco and its subsidiaries manufacture cast methyl methacrylate plastic sheets and other plastic products at plants in Sanford, Me.; Wichita, Kan.; Kearny, N. J.; and Toronto, Canada. Cyanamid recently announced its entrance into the field as a producer of methyl methacrylate.

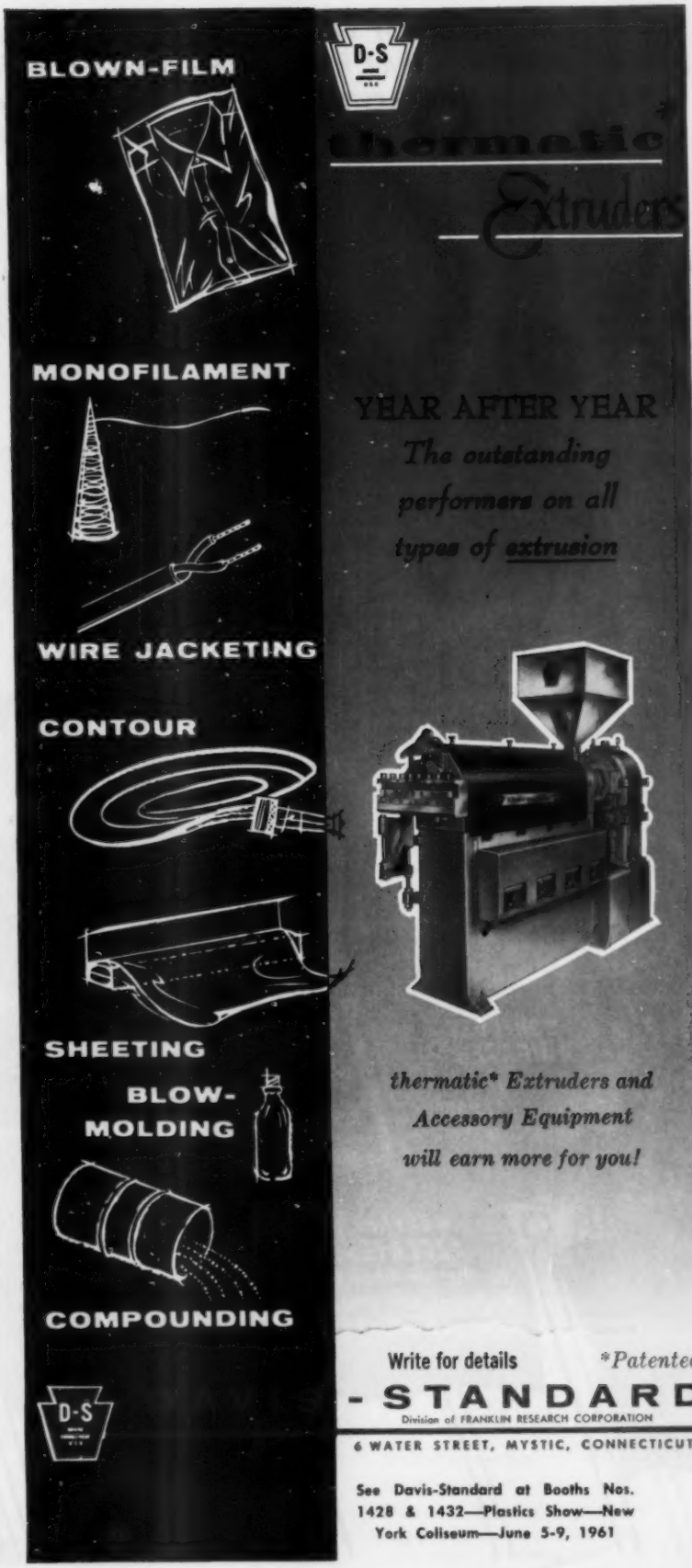
Rapid-American Corp. has acquired all outstanding stock of **Cellu-Craft Products Corp.,** New Hyde Park, N. Y. converter, designer, and printer of flexible packaging materials. Cellu-Craft, with sales in excess of $10 million, was organized in 1937. In addition to its main plant, the company operates three divisions. They include: **Laminex Corp.,** New Hyde Park extruder and laminator of packaging materials; **Gustave Rubner Inc.,** New York manufacturer of gift wrappings, plastic wall papers, and display materials; and **Transpak Inc.,** Hialeah, Fla., printer and converter of flexible packaging materials.

Rapid-American's portfolio, in addition to the acquisition of Cellu-Craft, includes a printing plate manufacturing company, a metal products plant, a plastic specialties division, and a catalog merchandising house.

Deceased

Norman Leeds Jr., 59, assistant general manager of the **Raybestos Div.** of **Raybestos-Manhattan Inc.,** Stratford, Conn., died suddenly March 12.

Wilhelm Uhrig, top executive of Germany's **Alkor G.m.b.H.,** **(To page 432)**



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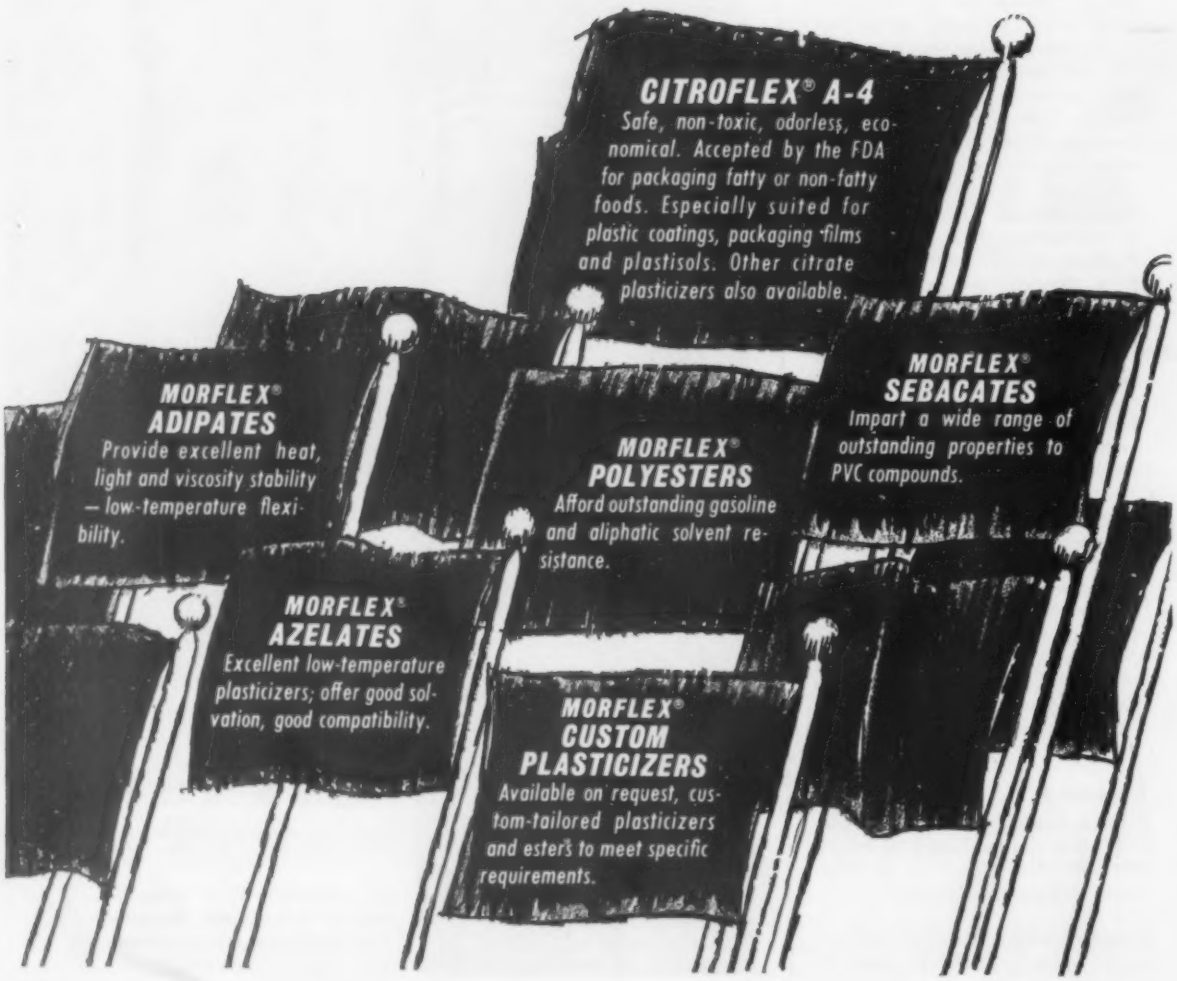
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Excellent low-temperature plasticizers; offer good solvation, good compatibility.
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Available on request, custom-tailored plasticizers and esters to meet specific requirements.

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HOUSTON, TEXAS	CApitol 5-0356
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KANSAS CITY, MISSOURI	VIctor 2-3306
LOS ANGELES, CAL.	LUdlow 9-6321
MIDDLETOWN, CONN.	DIamond 6-9606
MILWAUKEE, WIS.	Broadway 1-3021
MINNEAPOLIS, MINN.	Federal 6-6631
NASHVILLE, TENN.	CYpress 2-7016
NEW YORK CITY, N. Y.	WOrth 4-2990
OMAHA, NEBRASKA	341-7600, 7610
PHILADELPHIA, PA.	GReenwood 3-4477
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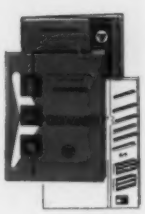

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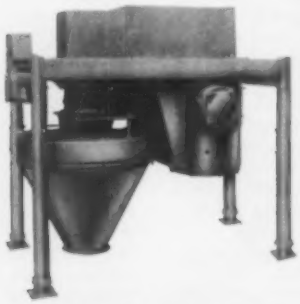

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THE PLASTISCOPE

(From page 429)

manufacturers of vinyl plastics, died in Munich, March 21, following a brief illness.

Coming events

Plastics groups

June 5-9: S.P.I. 9th National Plastics Exposition and National Plastics Conference, Coliseum and Commodore Hotel, New York, N. Y.

June 8, 9: United Plastics Distributors Assn. 6th Annual General Meeting, Hotel Taft, New York, N. Y.

June 15, 16: 3rd Annual Plastics for Tooling Seminar sponsored by Purdue University in cooperation with S.P.I. and American Society of Tool & Mfg. Engineers, Purdue University, Lafayette, Ind.

June 16-25: Europlastica 1961, Palais des Floralies—Parc, Ghent, Belgium. Contact: H. P. Persin, Sec. General at above address.

June 21-July 1: Interplas 61, 6th International Plastics Exhibition and Convention, Olympia, London, England. Contact: John L. Wood, Dorset House, Stamford St., London SE 1, England.

Sept. 22-Oct. 1: International Plastics Fair, Copenhagen, Denmark. Contact: Int. Plastics Fair Secretariat, 10 Puggaardsgade, Copenhagen.

Oct. 17-19: The Plastics Show of Canada, Canadian National Exposition, Toronto. Contact: W. B. Pryde, Show Manager, 481 University Ave., Toronto, Canada.

Other groups

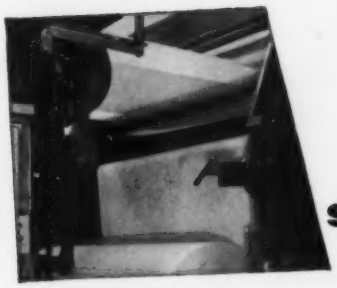
June 8-10: Manufacturing Chemists' Assn. 89th Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va.

June 9-17: ACHEMA 13th International Chemical Engineering Exposition and Congress, Frankfurt am Main, Germany.

July 10-14: 35th NHMA National Housewares Exhibit, McCormick Place, Chicago, Ill.

Sept. 5-8: 11th National Chemical Exposition, sponsored by Chicago Section, American Chemical Society. International Amphitheatre, Chicago, Ill.

Oct. 18-20: Packaging Institute 23rd Annual National Packaging Forum, to be held at Biltmore Hotel, New York, N. Y.—**End.**



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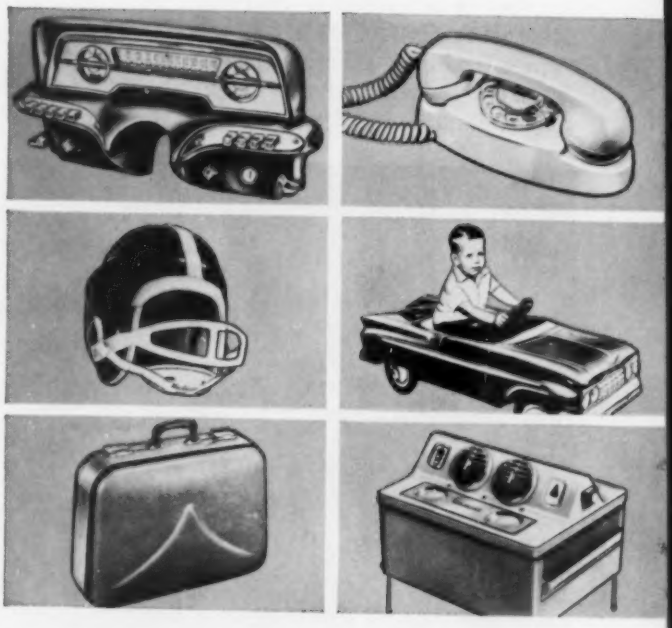

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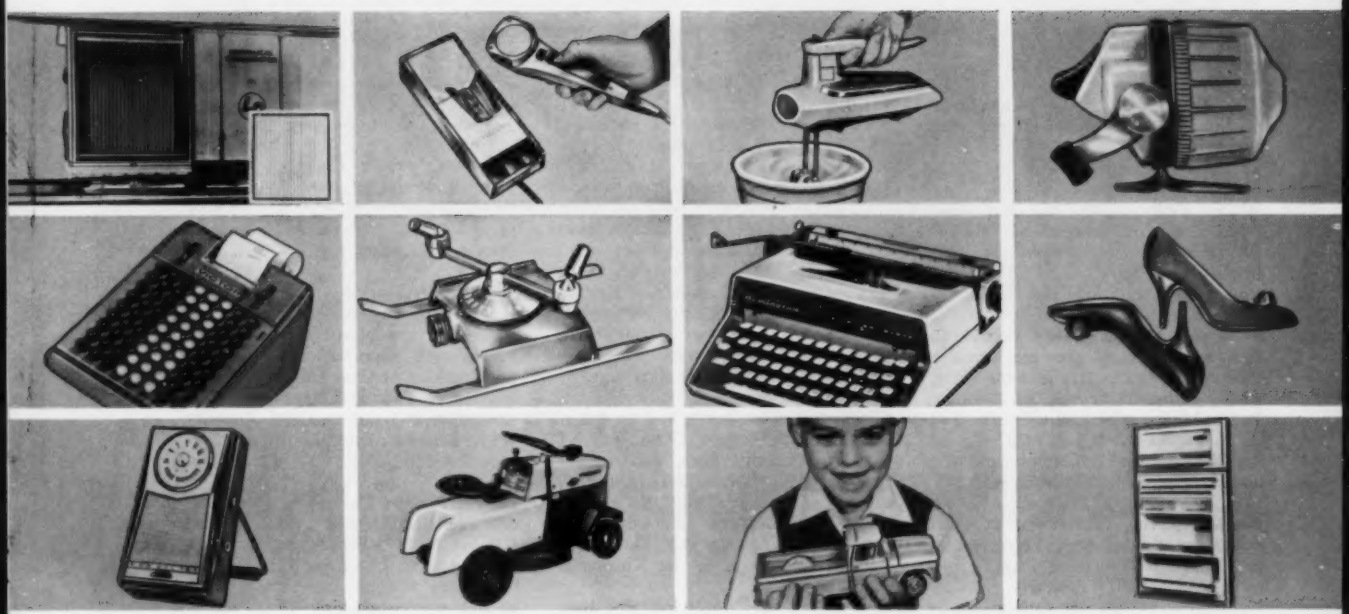

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COMPANIES...PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Allied Chemical Corp.—Plastics Div.: Walter J. Lilley appointed dir. of development, and **Bruce T. McMillan,** dir. of applications. Other Plastics Div. appointments are **Dr. R. L. Feder,** mgr. Tonawanda, N. Y. development laboratory; **Dr. H. A. Hoppens,** mgr. tech. service; **K. D. Meiser,** mgr. Toledo, Ohio development laboratory; and **E. C. Schule,** mgr. applications research.

Hooker Chemical Corp.: Thomas E. Moffitt, pres. since 1957, elected chrmn. of the board and chief exec. officer. Succeeding him as pres. is **F. Leonard Bryant,** former exec. v-p. **Thomas F. Willers,** formerly a v-p of the corp., becomes exec. v-p.

The Kordite Co., Div. of National Distillers & Chemical Corp., has formed a National Packaging Sales Div. with Eastern, Central, and Western divisional offices in New York, N. Y.; Chicago, Ill.; and San Francisco, Calif. **Richard Merrill** named Eastern sales mgr.; **John Sullivan** heads the Central Div.; and **William Peterson** is Western sales mgr.

Minnesota Mining & Mfg. Co.: R. C. Bertelsen, supt. of pressure sensitive tape operations at Hutchinson, Minn. plant, promoted to mgr. of 3M's St. Paul, Minn. tape plant succeeding **A. F. Jacobson,** who is now mgr. of the 3M tape and adhesives, coatings, and sealers plant in Bristol, Pa.

Bemis Bro. Bag Co.: Walter P. Conway, former sales mgr., Terre Haute, Ind. plastic package plant, transferred to **Air-Formed Products Corp.,** Nashua, N. H., a newly-acquired subsidiary, as national sales rep. **Shelby W. Brown Jr.,** former Fla. sales rep., succeeds Mr. Conway as sales service mgr. at the Terre Haute packaging plant.

Union Carbide Plastics Co.: John B. Honish appointed tech. rep., S. Atlantic sales region. He will be located in the company's Greensboro, N. C. dist. sales office. **Lawrence J. Kelly** and **Edwin A. Jenkins Jr.** appointed tech. reps., metropolitan New York region, with headquarters in Clifton, N. J.

Shawinigan Resins Corp., Springfield, Mass.: **W. Roy Elliot** elected pres. and gen. mgr.; **William H. Bromley** appointed v-p marketing; **Dr. Robert N. Crozier,** named v-p research; and **John C. Kenny,** becomes v-p production and engineering.

Olin Mathieson Chemical Corp. has formed an Organics Div., which consolidates all activities of the Energy Div. and also includes the company's organic chemicals operations at Brandenburg, Ky., automotive and specialty chemicals facilities at Rochester, N. Y., and related sales and research activities. **D. J. C. Copps,** corporate v-p, named gen. mgr. Other officers in the newly formed div. are: **N. A. Hamilton,** v-p and asst. gen. mgr.; **G. A. Siegelman,** v-p, production; **J. L. Wetzel,** v-p, marketing; **H. A. Bruson,** v-p, research; **C. W. Smith,** v-p, product development; and **S. J. Wommack,** dir. of research and engineering. The div. manufactures solvent and chemical intermediates.

AviSun Corp., Philadelphia, Pa. mfr. of polypropylene polymer, film, and fiber: **Henry E. Wessel** advanced to dir. of marketing, and **Dr. W. Paul Moeller** named mgr., International Dept., responsible for overseas operations, including sales and technical agreements involving the company.

Koppers Co. Inc.—Plastics Div.: Jones P. Sipe promoted to product mgr., Dylite expandable polystyrene. He is succeeded by **R. R. Bench** as Eastern dist. sales mgr. **S. M. Robertson,** Western dist. sales mgr., promoted to product mgr., polystyrene. He is replaced as Western dist. sales mgr. by **John H. McSparran.**

Rogers Corp., Rogers, Conn., mfr. of plastics, specialty fiber, and rubber materials: **T. H. Johnston, Jr.** named dir. of mfg., a new post. He will be responsible for mfg. activities in all four Rogers divs. **David R. Dunay** appointed sales mgr. in the Northeast.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.: **John I. Hughes,** mgr. of marketing services, Polychemicals Dept., transferred to the company's Development Dept. He is succeeded by **Ray M. Campbell,** asst. mgr., Teflon TFE-fluorocarbon resins marketing section. **Emory D. Champney Jr.,** Mfg. Div. product mgr., replaced Mr. Campbell. **Gordon H. Lewis** succeeds Mr. Champney.

Improved Machinery Inc., Nashua, N. H. mfr. of molding machinery: **Peter Smith, David Wilbur,** and **Alfred Gamache** appointed sales and service reps. in New York, N. Y.; St. Louis, Mo.; and Nashua, respectively.

Plastics Mfg. Co., Dallas, Texas mfr. of melamine dinnerware: **W. L. Cone Sr.,** formerly v-p and gen. mgr., elected pres., succeeding **Elgin B. Robertson,** now chrmn. of the board. **James E. Joy** named v-p, mfg.; and **Richard Cone,** v-p, sales, for both housewares and commercial divs. **W. Lloyd Cone Jr.** appointed chief engineer in charge of R & D; **Gilbert Robertson** in charge of production operations. Plastics Mfg. has grown from 17 employees in 1946 to 345 today and retains 50 reps. throughout the country.

Tri-Point Industries Inc. is the new name of **Tri-Point Plastics Inc.,** Albertson, N. Y. extruders and processors of Teflon products.

Formica Corp., Cincinnati, Ohio: **George E. Power** named dir., R & D. He will administer R & D activities, including polymer development work being done at **American Cyanamid Co.'s** research div. at Stamford, Conn. **Alex J. Malashevitz** named assoc. research dir. He will direct increased emphasis on resin development work. Formica is a subsidiary of Cyanamid.

Heyden Newport Chemical Corp.—Nuodex Products Div.: William B. Philipbar appointed sales development mgr. **John A. Merwin Jr.** joined the sales staff, Eastern regional dist.

Thatcher Glass Mfg. Co., San Francisco, Calif. mfr. of glass and plastic containers and plastic closures: **Paul Martersteck** appointed to newly-created position of West Coast sales mgr. assisted by **Thomas Foley,** assigned to operations in Southern Calif. **Timothy W. J. Costello** named branch mgr. responsible for Northern Calif. sales.

Prewitt Plastics Co. is the new name of **Prewitt Aircraft Co.,** Clifton Heights, Pa. The new name recognizes the expansion of the company's activities in the field of reinforced plastics as well as construction of helicopter rotor blades. Efforts will be directed to sandwich and laminated structures, and to missile insulation and components. **Franklin J. Burchfield** elected pres., succeeding **Richard H. Prewitt,** now chrmn. of the board.

Dr. William E. Thompson appointed dir. of research for **Archer-Daniels-Midland Co., Central Research Laboratory,** Minneapolis, Minn. The company is planning construction of a new central research laboratory building in Bloomington, Minn.

Herbert Schoenfield, formerly product sales mgr., promoted to asst. mgr., urethane chemicals dept., **Witco Chemical Co. Inc.,** N. Y., N. Y. The company recently completed a $250,000 expansion of its Chicago, Ill. facilities for development and production of urethane chemicals.

S. K. Lamden appointed v-p of plastic hose sales for **Dayco Corp.,** Dayton, Ohio mfr. of plastic vacuum

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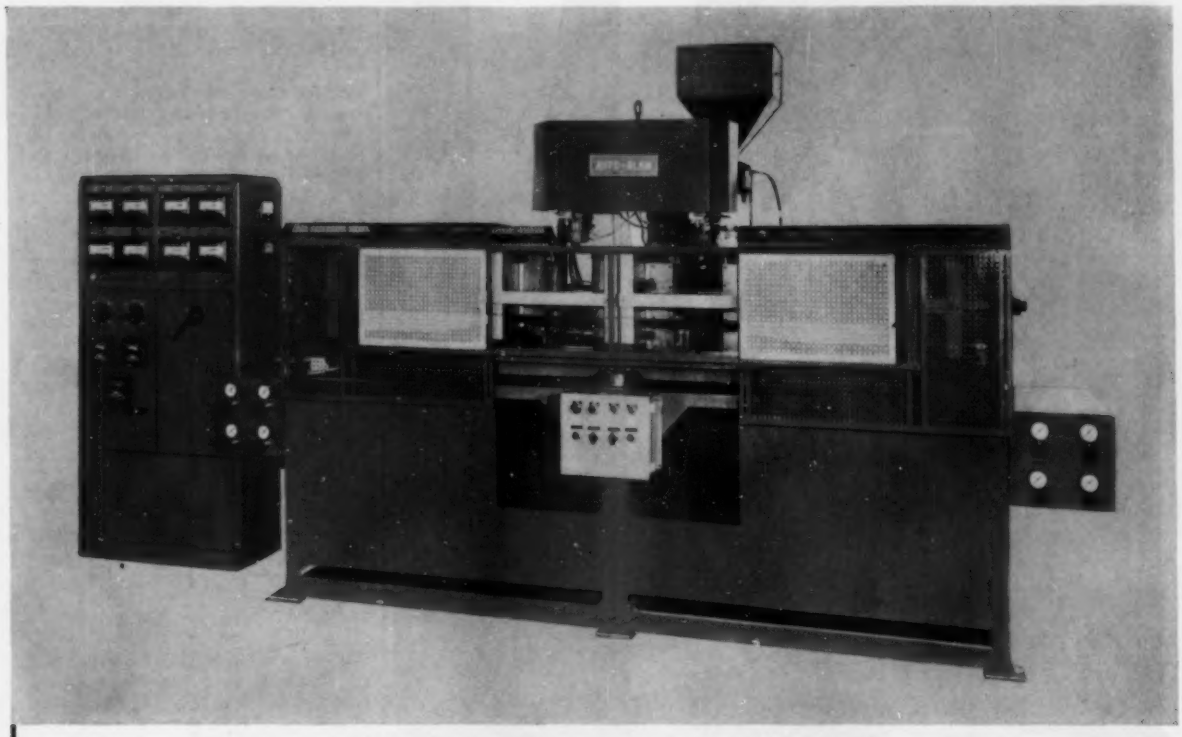

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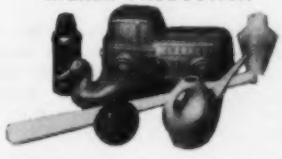

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cleaner, hair dryer, swimming pool, vent, and exhaust hose. He joined the corporation in 1947 as manager of the special products development and was named sales mgr. of the plastic hose div. when it was formed in 1954.

Eric M. Roth appointed v-p and gen. mgr. of **Trans-Canada Plastics Ltd.**, Toronto, Canada. He is a member of S.P.E. as well as the Plastics Institute of Great Britain.

Richard D. Moroney named project engineer for **G. T. Schjeldahl Co.**, Northfield, Minn. mfr. of packaging machinery, industrial tapes, air-supported buildings, and high altitude research balloons.

Louis E. Georgevits appointed mgr., tech. sales to the paper industry, for the Thermoplastics Div. of **The Borden Chemical Co.**

Lyman L. Campbell elected v-p in charge of engineering for **Package Machinery Co.**, E. Longmeadow, Mass. mfr. of automatic packaging equipment, injection molding presses, and die casting machines.

D. L. McCuen appointed product mgr., Industrial Chemicals Div., **Pittsburgh Chemical Co.**, Pittsburgh, Pa., responsible for planning and marketing of the firm's line of plasticizers.

William A. Kwozalla named Midwestern sales rep., for **Spraylat Corp.**, New York, N. Y. mfr. of spray-on strip-off protective coatings.

Dr. Alexander E. Vajda joined **Armour Research Foundation** of **Illinois Institute of Technology**, Chicago, Ill., as group leader of polymer research in ARF's chemistry research div.

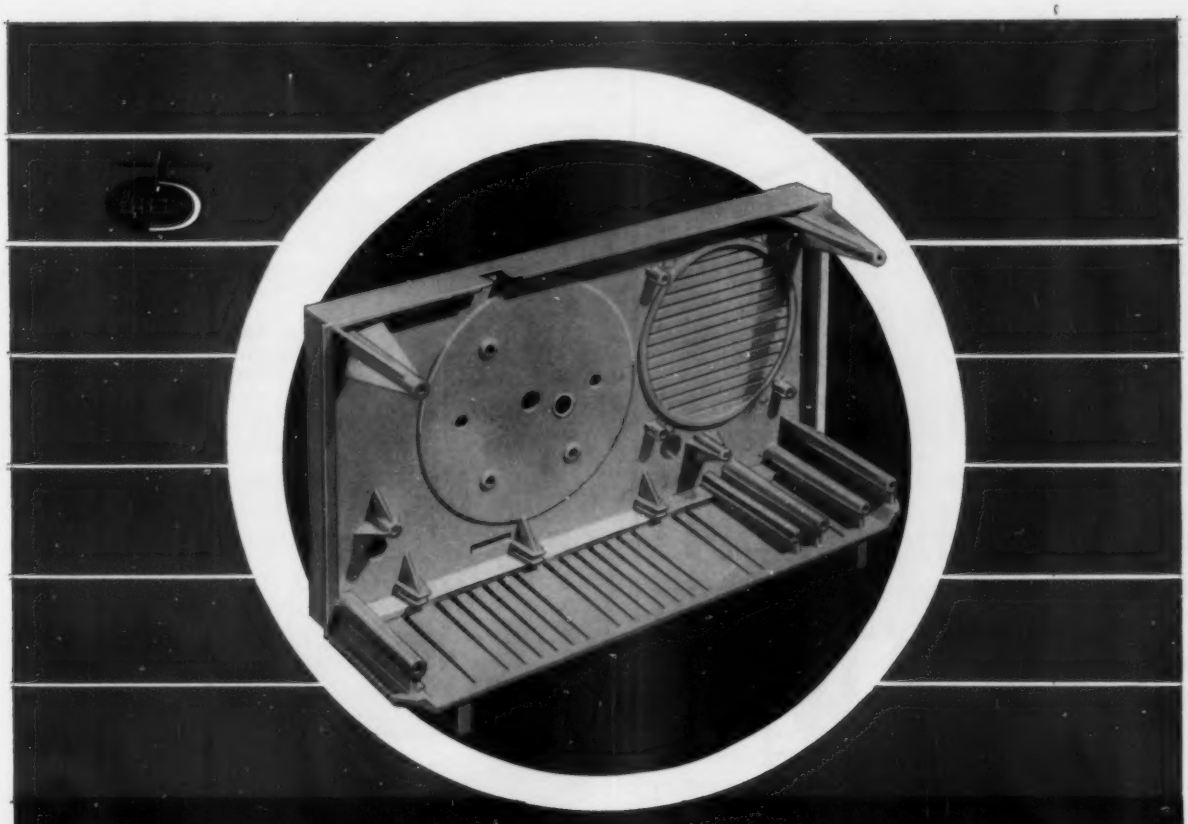
Richard T. Dale named works mgr. of **Resistoflex Corp.**, Roseland, N. J. mfr. of hose, rigid piping, and components made of Teflon.

Leonard J. Malin named plant mgr. for **Chem Seal Corp.**, Los Angeles, Calif. producer of polysulfide, epoxy, silicone, and polyurethane materials used in construction, electronics, marine, and aircraft industries.

William E. Lowery joined **Applied Plastics Div., Hexcel Products Inc.**, as tech. rep., urethane rigid foam materials. He will headquarter in the El Segundo, Calif. plant.

Correction

Expansion section of The Plastiscope (MPI, Feb. 1960, p. 227): E. I. du Pont de Nemours & Co. and Mitsui Petrochemical Industries Ltd., which formed Mitsui Polychemicals Co., a jointly-owned Japanese company, inform us that the subsidiary will produce low-density or conventional high-pressure-processed polyethylene, rather than the high-density PE erroneously mentioned.—**End**



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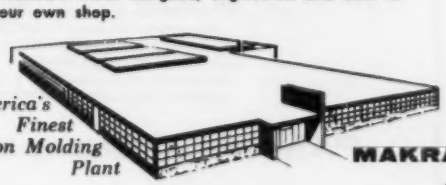

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- **THE HOT LIQUID PROCESS** opens up new opportunities in making vinyl parts which are impractical by the usual recirculating hot air method but parts presently made by the hot air method can also readily be molded on the new equipment.
- **NEW CASTING APPLICATIONS** and new industries where complex and very large parts are needed or where there are very exacting physical and chemical requirements present definite opportunities for this new plastisol molding method.
- **OPERATIONAL CYCLES ARE** about ¼ of the usual time.
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FOR SALE — 100 gal. Baker Perkins T347SS jacketed dispersion blade mixer; 4000 gal. T304 stainless horiz. tank, ASME 50# WP; Baker-Perkins 200 gal. jacketed sigma-blade mixers; 200 gal. and 500 gal. stainless jacketed reactors; 1350 gal. T347 stainless jacketed resin kettle; American 42"x120" dbl. drum dryer, ASME code, stainless trim; 2750 gal. T316 stainless pressure tanks, coils, dished heads; 1800 gal. T316SS jacketed and agit. resin kettle; 800 sq. ft. T316SS shell and tube heat exchangers; Baker-Perkins #15-UUMM, 100 gal. jktd. dispersion blade mixer, 100 HP; Worthington 70 cu. ft. rotary blender; we pay cash—top dollar—for idle, surplus equipment. Perry, 1429 N. 6th St., Phila. 22, Pa.

FOR SALE—(3) Automatic Stokes, 200 D3-25 Ton, (1) 600 B Strauss 50 ton, (2) 500 ton R-D Wood Embossing Presses 21" Dia. Ram, 3M Working Pressure Electric Platens, 55"x32"—500 ton, 2-ram, 60"x60" Platen Area, 3—24x24x14" Ram, 24"x54"x14" Dia. Rams, 350 ton 8—3½" openings 6 oz. Watson-Stillman Injection, Baker Perkins size, 15, 4 day churns. Brewster Rubber Machinery Co., 349 E. Exchange Street, Akron 4, Ohio, FRanklin 6-2911.

FOR SALE — Reed Prentice Injection Molding Machine 10D8 — 1954 model. Good running condition. Sacrifice priced at $5,500.00—Fawn Plastics Co., CLearbrook-2-1600—Timonium, Maryland.

FOR SALE—(2) Stokes model 741—50 ton automatic molding presses; (2)—300 ton Dunning & Boschert molding presses; (2) Bipel 35 ton preform presses; (1) Hartig 2" electrically heated plastics extruder; (3) Ball & Jewell rotary cutters 7½ HP, 10 HP, 15 HP. Chemical & Process Machinery Corp., 52 9th Street, Brooklyn 15, N.Y., HY 9-7200.

PLASTIC PREHEATERS for sale: 10 KW Westinghouse & 5 KW G.E., also Girdler Dielectric Drying or Baking Oven and Stokes 300 ton Upstroke Hyd. Press Model 250A. Universal Machinery & Equipment Co., 1630 N. 9th St., Reading, Pa., FRanklin 3-5103.

VACUUM STEAM KETTLE—42" IDx22" deep. Fully equipped with racks, exhauster pump, 15 H.P. motor, etc. for vacuum molding. A1 condition. Pacific Moulded Products, Los Angeles. AD 1-1151.

MOST MODERN PACKAGING AND PROCESSING MACHINERY Available at great savings. Baker Perkins, W. & P. and Day Double Arm Steam Jacketed Heavy Duty Mixers—25, 50, 75, 100, 150 and 200 gal. capacities. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers, Jacketed and Unjacketed. Also wood and enamel. H. K. Porter 650 gal. Steam Jacketed Double Spiral mixers. B. P. 100 gal. Jacketed Stationary Vacuum Double Arm Mixer. Day Imperial 75 gal. Double Arm Mixer, Sigma, Dispersion Blades, Mikro Pulverizers, Models Bantam, 1SH, 2TH, 3TH and 4TH. Fitzpatrick Models D, K-7 and K-8 Stainless Steel Comminuters. Colton 2RP, 3RP, 3B, 5½ T Tablet Machines. Stainless Steel Jacketed Mixing Kettles 100 and 150 gal. capacities. Day Ro-Ball Sifters. Package machinery, Hayssen, Scandia, Wrap King, Campbell, Miller Wrappers. Cartoning machines—Ceco, Pneumatic Scale, Jones. Filling machines—all types and sizes. Union Standard Equipment Company, 318 Lafayette Street, New York 12, N.Y. Phone: CAnal 6-5333.

BLOWN FILM DIES for plastic—(1) —10 inch diameter centre feed die. (1)—5 inch diameter centre feed die extra rings. Dies in perfect condition. Box 6901, Modern Plastics.

INJECTION MOLDING—HPM 9 oz; Hydraulic Press, French oil semiautomatic 100 ton; Elmes 60 ton high speed; Mill-Farrell 16x36; Baker Perkins SS, 2 arm, jacketed, vacuum, hydraulic tilt, 100 gal-50HP, also SS tank 11, 100 gal. Mixer 2 arm 150 gal. Day Imperial steel; Extruder 3" elec. heated; Ram extruder. Machinecraft Corp., 800 Wilson Ave., Newark 5, New Jersey. MI 2-7634.

MAKE YOUR N.Y. VISIT A Double Header; See us in Booth 919. Then see us at Headquarters 20 minutes from the Coliseum Exposition; Extruders: Royale No. 2, NRM 1½"; Hartig 4½" & 6"; Electrically Heated, Preform Presses; Colton 5½, Stokes T.RB2, DD2, No. 280. Hyd. Presses: Robas Press, 23" Ram, 14" Stroke, 30"x48"; Stokes 150 Ton Self Contnd. Molding Presses; 2 HPM Self Contained 25 Ton; others; Stokes Impregnator 5648; 2 Roll F-B Mills 14"x30", 16"x42" and 22"x60"; Baker Perkins Mixers 5 Gal. to 300 Gal. Dbl. Arm. Jktd. Day Mogul Vac. Mixer 150 Gal. Day Gearless 125 Gal. Pony Mixer; Blaw Knox Conical Blender 300 Cu. Ft.; Day 3 Roll Hi Speed Mills 14"x30"; F-B Banbury Mixer Model "oo". Sturtevent 30" Stainless Micronizers Jackson & Church Autoclave 41"x39"; Rotary Cutters by Sprout Waldron, Ball & Jewell and Abbe. Rotary Dryers, Continuous Centrifuges, Sifters, Condensers, Ball Mills etc. Send for Complete Catalog. First Machinery Corp., 200 Tenth St., Brooklyn 15, N. Y. STerling 8-4672 Cable: Effemcy.

FOR SALE—Five Stainless Steel Mesh Conveyors 39'x32"—25'x32"—8'x42"—5'x 42"—5'x42". One Belt Conveyor—18'x80". Reply Box 6900, Modern Plastics.

INJECTION MACHINES for Immediate Removal—(1)—1951 C-1, 12 oz. DeMattia (hydraulic). (2) 1954 10D-12 oz. Reed Prentice. (2) 1955 HA2-125 2 oz. Impco. (1) 1956 HA4-175 4 Oz. Impco. These are in excellent condition and can be inspected while in operation (by appointment). Write or phone for full particulars to: A. C. Martinelli, Rogers Plastic Corporation, West Warren, Massachusetts, HEmlock 6-7744.

FOR SALE—(1)—P-K 1 cu. ft. 304 SS "V" Blender; (1)—No. 3 Banbury Mixer 75 HP; (3)—Baker Perkins 50, 100 and 150 gal. Sigma Blade Jacketed Mixers; (1)—No. 1 Ball & Jewell Rotary Cutter; (2)—Cumberland Rotary Cutters, No. ½ and No. 18; (3)—Mikro Pulverizers, Bantam, 1SH and 1SI; (5)—Stokes Preform Presses, models R, T, DD2, DDS2 and D4; partial listing, send for details. Brill Equipment Company 35-55 Jabez St., Newark 5, N.J. Tel: Market 3-7420.

FOR SALE—1957 Hartig 2" extruder 21:1 L/D Ratio, 10 HP Reliance VS Drive, Prewire cabinet with 5 Wheelco 297 controllers. Electrically heated and water cooled. Extra head clamp, breaker plate, die and screw. Has had limited service. Reply Box 6896, Modern Plastics.

FOR SALE—Stokes Model 741 Fully Automatic Molding Presses. Complete with all controls. Stokes Model 294 Single Punch Tablet Press. Completely rebuilt with variable speed drive. Injection Molding Machines—1 oz. Van Dorn, 1½ oz. Leominster, 3 oz. Fellows, 4 oz. Moslo, 4 oz. Reed Prentice, 4 oz. Harvey, 8 oz. Reed Prentice, 12 oz. DeMattia, 12 oz. Reed Prentice, 16 oz. Watson Stillman, 16/20 Reed Prentice. All in stock. Immediate delivery. Scrap Grinders, 1½ HP up to 50 HP available. 6"x12" Erie Engineering Company Lab Mill. Variable speed drive. 6" Hartig Extruder, 16.5:1 Electrically heated barrel. Complete with all controls and motor drive. We have a full line of laminating presses, molding presses, mills, calenders, extruders, injection molders, scrap grinders, coating equipment and other accessories for the Plastic Industry. We Will Finance. Johnson Machinery Company, 90 Elizabeth Ave., Elizabeth, New Jersey, ELizabeth 5-2300.

FOR SALE—(1) Abbott Vacuum Forming Machine, size 60" x 90" forming area. 2 sided, fully automatic. Complete with all electrical wiring and boxes. Includes two cooling blowers. Only a few machines this size in country. Acme Laminating and Plastics Co., 7207 E. McNichols Road, Detroit 12, Michigan

FOR SALE—Heavy duty Plastic Compression Moulding Presses with upmoving chrome plated rams 2-400 ton 30"x 30" platen, 45" daylight $2,800. each, 2—150 ton 24"x24" platen, 40" daylight $1,-100. each, 2—100 ton 15"x15" platen, 35" daylight $900. each, 4 steel steam-platens 50"x66"x2½" $240. each. Reply Box 6891, Modern Plastics.

Machinery Wanted

WANTED—To purchase Stokes 50 ton Zelov automatic. State model number, serial number, 220 volt. Reply Box 6893, Modern Plastics.

INSTRON, RIEHLE, OR BALDWIN UNIVERSAL Testing Machine Wanted. 20,-000 to 30,000 lb. capacity. Must be in excellent condition suitable for environmental testing. Reply including complete description and price. The Fiberite Corporation, 516 W. 4th Street, Winona, Minnesota.

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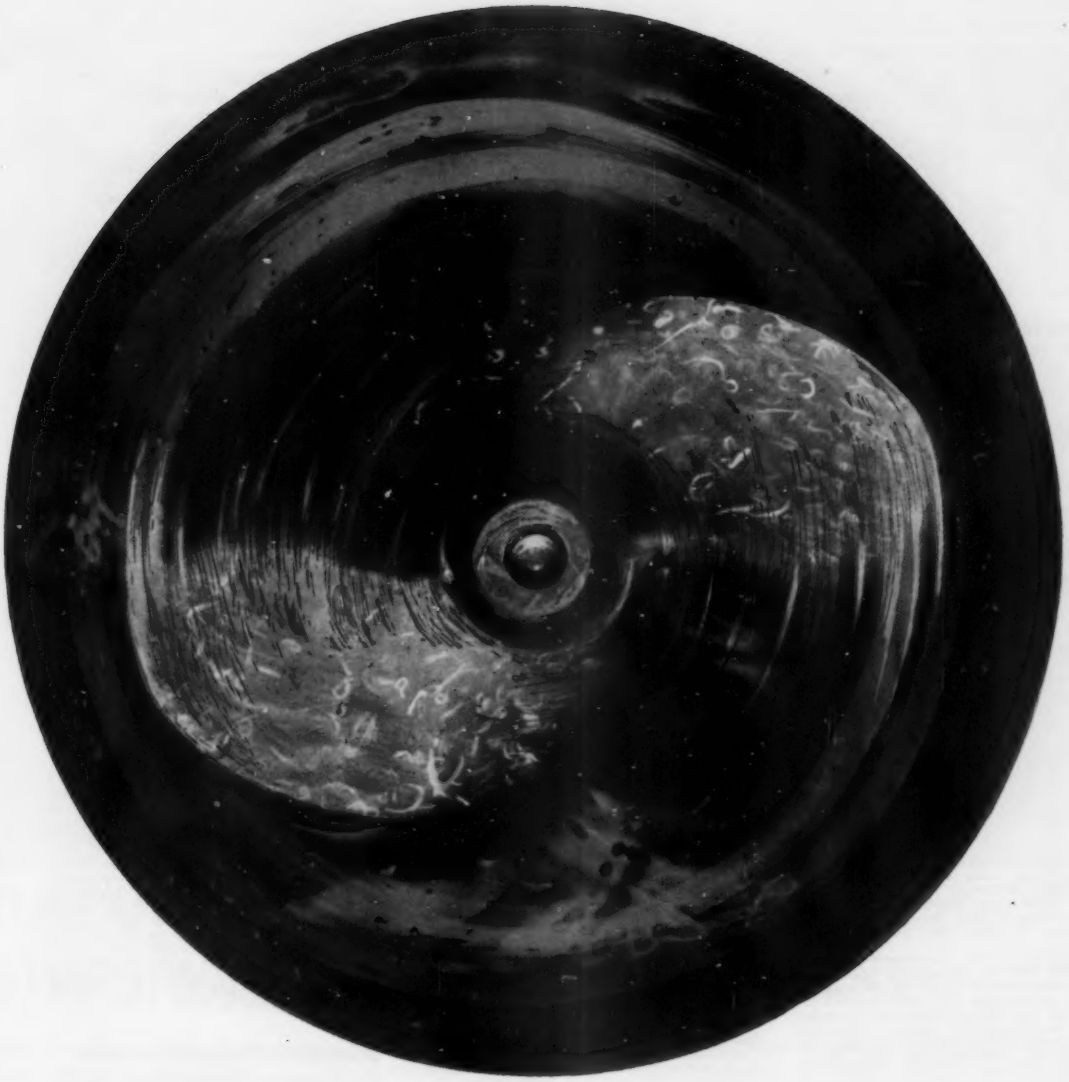

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PLASTICS DIVISION
40 Rector Street, New York 6, N. Y.

Allied Chemical
BASIC TO AMERICA'S PROGRESS

(Continued from page 442)

Materials Wanted

GET THE TOP MONEY FOR PLASTIC SCRAP—Now paying top prices for all thermoplastic scrap. Wanted: polystyrene cellulose, acetate, vinyl, polyethylene, butyrate, acrylic nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. Write, Wire, Today! Reply Box 6897, Modern Plastics.

PLASTIC SCRAP WANTED—Clear acetate and butyrate sheet scrap, cast acrylic, acrylic molding powder, styrenes, polyethelene, etc. We pay top dollar for your plastic scrap and surplus molding powders. Write, Wire or Phone Collect—TL 3-3111—Philip Shuman & Sons, Inc., 571 Howard St., Buffalo, N. Y.

Materials For Sale

NYLON PELLETS type 6, semi dull and semi bright for sale. Oscar Chandler & Co., Inc., 220 Fifth Avenue, New York, New York, MU 9-5780.

Molds Wanted

INJECTION MOLDER in New York Area would like to be contacted by moldmaker with facilities for testing molds before delivery. Reply Box 6902, Modern Plastics.

WE ARE INTERESTED in quotation on plastic fly swatter blades. If you have molds, contact. The Hi-Flier Manufacturnig Company, 510 Wabash Avenue, Decatur, Illinois.

Help Wanted

REPRESENTATIVES—Who Contact Vacuum Metalizers. Midwest Technical Service, Downers Grove, Illinois.

PLANT ENGINEER—Opening in metropolitan area for man with practical experience relating to plastic compounding machinery. Job involves new installation design, improvement of existing processing methods, maintenance and supervision. All replies held in strictest confidence. Send reply with salary requirements to Box No. 6892, Modern Plastics.

MANUFACTURERS REPRESENTATIVE—Wanted for sales of Thermoforming, Expandable Styrene, Die Cutting and Blister Packaging Equipment. Opening for experienced men. Send complete information to Box No. 6916, Modern Plastics.

CHEMIST VINYL—Expanding operations require experienced graduate chemist for product application and development on stabilizers for Polyvinylchlorides compositions. Send complete resume to Director of Research & Development, Nuodex Products Div., 1075 Magnolia Ave., Elizabeth, N. J.

SALES ENGINEER to show use of reclaimed fluorocarbon resins. Salary, commission, and other benefits including profit sharing. Excellent opportunity. Reply in confidence to Davies Nitrate Co., Inc., 114 Liberty Street, New York 6, N. Y.

PIPE ENGINEER—Thoroughly familiar with production and testing to head up new pipe extrusion division, particularly interested in vinyls. Write full details. Box No. 6898, Modern Plastics.

PRECISION INJECTION MOLD Making & Repair Supervisor. Must have worked as a precision mold maker and repairman and progressed to supervisory level. Must be able to assume complete responsibility for directing large precision mold making and repair group. Please send resume with salary requirements in confidence to: Thomas J. Donovan, Manager, Industrial & Public Relations. TUPPER COMPANY, Post Office Box Blackstone, Massachusetts.

FOREMAN - IMPREGNATING AND COATING—New England plant requires a man thoroughly experienced in the nitrocellulose and plastic impregnating and coating fields. Some knowledge of color matching is also required. Responsibilities include maintaining of production schedules, supervision of department personnel and quality control. Excellent working conditions and generous fringe benefits. Send complete resume including salary requirements. All replies held in strict confidence. Box 6903, Modern Plastics.

WANTED—Project Engineer or Supervisor with profile extrusion experience to take charge of extrusion department as well as customer contact in established Detroit area plant. Reply Box 6912, Modern Plastics.

FIBER GLASS RESEARCH—Position available for organic chemist with Ph. D. or equivalent experience for long range program on woven fiberglas. Improved resin-to-glass bond in reinforced plastics, new fabric applications and improved finishes for fabrics are among the objectives. Applicants should be capable of independent and creative applied research and development, on a broader than normal basis. Excellent opportunity in rapidly expanding laboratory in Northern New Jersey. Best suburban living area plus excellent schools. Send resume in confidence to Director, Central Research Laboratory, J. P. Stevens & Co., Inc., 141 Lanza Avenue, Garfield, New Jersey.

SALES ENGINEERS—Standard mold set manufacturer requires additional representatives in several areas. Applicants must have proven selling abilities as well as moldmaking background. Protected territories. Write stating experience and qualifications. National Tool & Manufacturing Company, Kenilworth, New Jersey.

MANUFACTURERS REPRESENTATIVE—Manufacturer of plastic molding compounds require sales representative in Chicago area. Should be M.E. preferably now calling on molders but personality and initiative are compensating qualifications. Current business insures small immediate income. Reply in confidence with complete details to Box 6906, Modern Plastics.

SALES REPRESENTATIVES—A major Midwestern extruder of custom thermoplastic sheet requires the services of sales representatives experienced in the sale of thermoplastics to industry. Territories open primarily in the South and Southwest. Reply in confidence to Box 6908. Modern Plastics.

WANTED — MANUFACTURER REPRESENTATIVES. Quality custom injection molding firm requires top calibre representatives in Cleveland, Ohio, and Buffalo, New York. Protected territory on a straight commission basis. Give complete resume and references. Reply Box 6914, Modern Plastics.

RESEARCH CHEMIST OPPORTUNITY with leading national manufacturer. The aggressive effort of Butler Manufacturing Company in developing present and potential markets for plastics products has brought advancement in our staff and an opportunity to increase the technical strength of our Product Research Department. We are seeking a man who will be responsible for planning and carrying out research and development activities in high polymers and polyurethane chemistry. Successful candidate will conduct independent investigations in research, and cooperative activities with plastics manufacturing and sales departments toward translation of laboratory work into marketed products. He will be encouraged to pursue and maintain an advanced position nationally in the knowledge of this work and in the field of plastics research. Masters or doctoral training in organic or physical chemistry is preferred. Experience beyond formal training is desirable, but not required. School course work in polymer chemistry will be very helpful. Your reply, which will be kept in complete confidence, should include a personal resume and be sent at once to Mr. Orval W. Groves, Employee Relations Manager, Butler Manufacturing Company, 7400 East 13th Street, Kansas City 26, Missouri.

SALES REPRESENTATIVE WANTED—Products—Vinyl Profile Custom Extrusions. Territory—Florida and Southeastern States. Reply Box 6915, Modern Plastics.

Situations Wanted

SALES-MARKETING—Harvard Business School, Economics B.A., 28, with diversified experience as plastic purchasing coordinator for multi-plant packaging company. Good grasp of polyolefins and polystyrenes in packaging applications, as well as knowledge of industry. Previous experience includes sales and marketing oriented position. Seek opportunity to channel drive and ability into challenging career. Reply Box 6889, Modern Plastics.

MANAGEMENT — Chemical Engineer. Eighteen years proven accomplishments as plant manager, assistant plant manager, plant superintendent, production superintendent, head quality control, head engineering department. Experienced chemicals, fats and oils, foods, monomeric and polymeric plasticizers-esters, fatty acids, alcohols, sulfuric acid, adhesives, vitamins, dry-wet milling. Reply Box 6894, Modern Plastics.

CHEMICAL ENGINEER—35, thirteen years diversified experience; thermoplastics calendering, extrusion, and laminating; industrial coatings formulating; elastomers. Strong background in product and process development, technical service, market development, sales promotion, production, administration. Patents. Currently employed AAAA Company in responsible supervisory position where opportunity is limited. Reply Box 6899, Modern Plastics.

PLASTICS PRODUCTION AND MANAGEMENT—Complete Vinyl set-up. Calendering, Printing, Embossing and all finishing. Competition today requires this knowledge. Efficiency and quality control essentials maintained. Will travel and relocate. Reply Box 6910, Modern Plastics.

PLANT MANAGER—SUPERINTENDENT available. Injection—all phases. Compression, custom, dinnerware, urea & melamine. Spot molding expert. Advanced production control. 18 years experience. Reply box 6905, Modern Plastics.

CONSULTANT — Design, development, mold engineering, production—reinforced Plastics in premix, preform, hand layup, filament winding—for boats, marine applications, chemical process equipment, containers, aircraft, missiles, etc. Comprehensive knowledge of all plastic materials and processes—injection, compression, etc. P. ROBERT YOUNG. P.O. Box 22, MAMARONECK, NEW YORK.

Business Opportunities

WELL-KNOWN BRITISH FIRM forming part of large engineering group and producing substantial quantities of Phenolic Laminates, Flexible Insulation, Plastics and Rubber products, is seeking lines for expansion where specialized knowhow, patents or capital can restrict competition. The company has adequate technical and financial resources to manufacture and sell in Britain, Europe and the Commonwealth countries. A meeting with any patentee or manufacturer with lines capable of development in these territories would be welcome. Reply Box 6890, Modern Plastics.

WANTED TO BUY—A small established company producing polyethylene blown film tubing. Facilities for flat film extrusion also of interest. Box 6895, Modern Plastics.

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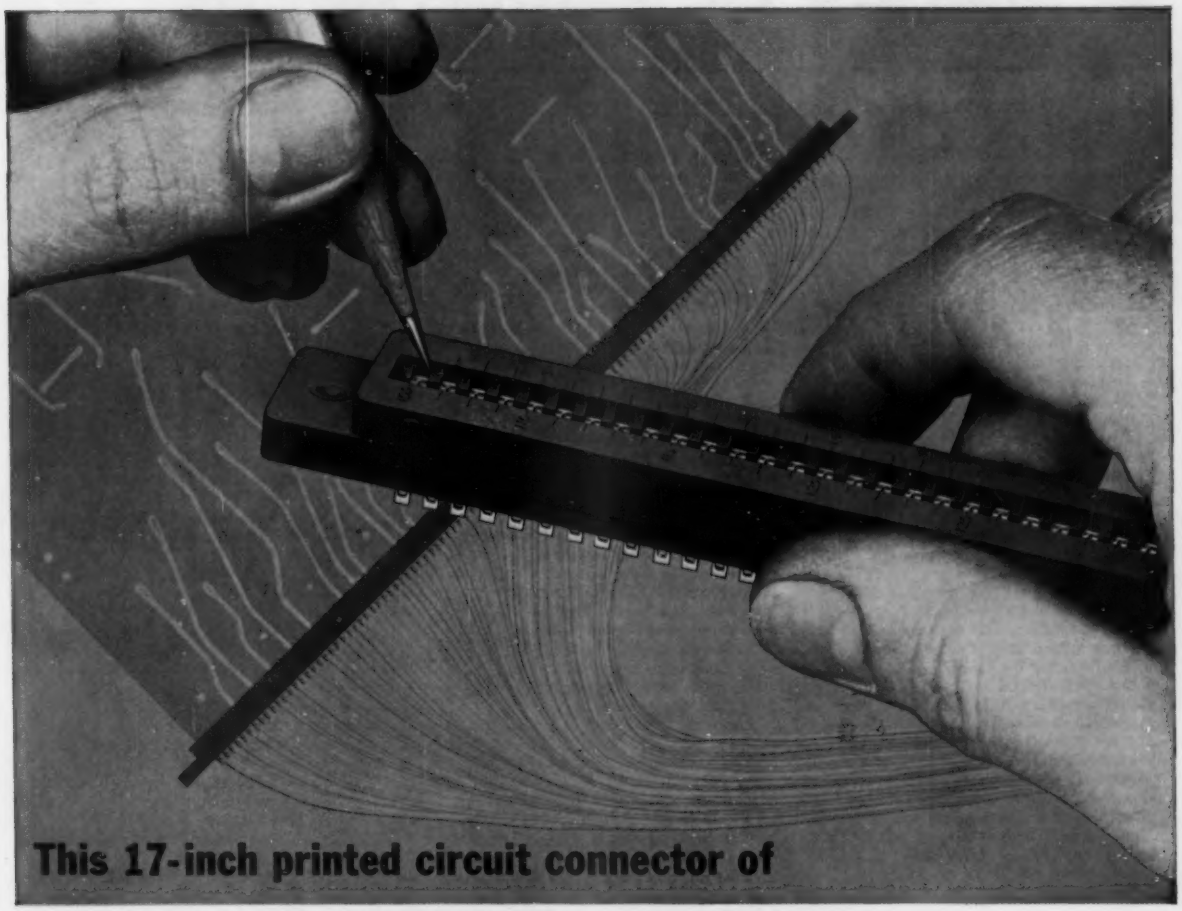

This 17-inch printed circuit connector of

DAPON® M OPERATES AT 450° F...
DIALLYL ISOPHTHALATE
STOPS WARPAGE AND MISALIGNMENT

Dimensional stability of compounds based on DAPON M keeps this connector straight and true: contacts are always accurately positioned.

This long connector is home base for hundreds of terminals. By molding it of thermosetting compound based on DAPON M, Viking Industries Inc. solved a number of design problems . . .

DAPON M gives the connector outstanding electrical and mechanical qualities. The resin permits 450°F continuous operating temperatures, has excellent dimensional stability and resistance to moisture. Its electrical resistance (measured in millions of megohms) remains unaffected by weeks of exposure to 100% relative humidity.

The material is easily molded. It has good hot strength, the piece is strong when cured. Neither cooling jigs nor multiple ejector pins are needed in removing the connector from the mold. Fast cycles are possible. The resin's high flex, tensile, and compressive strengths result in rugged moldings with high insert holding power and dependable performance.

DAPON M is recommended for use wherever:

- high operating temperatures are encountered
- top electrical qualities are a must
- better strengths are desired
- molding conditions pose a problem.

Visit us at the SPI Show, Booth 1404-10.

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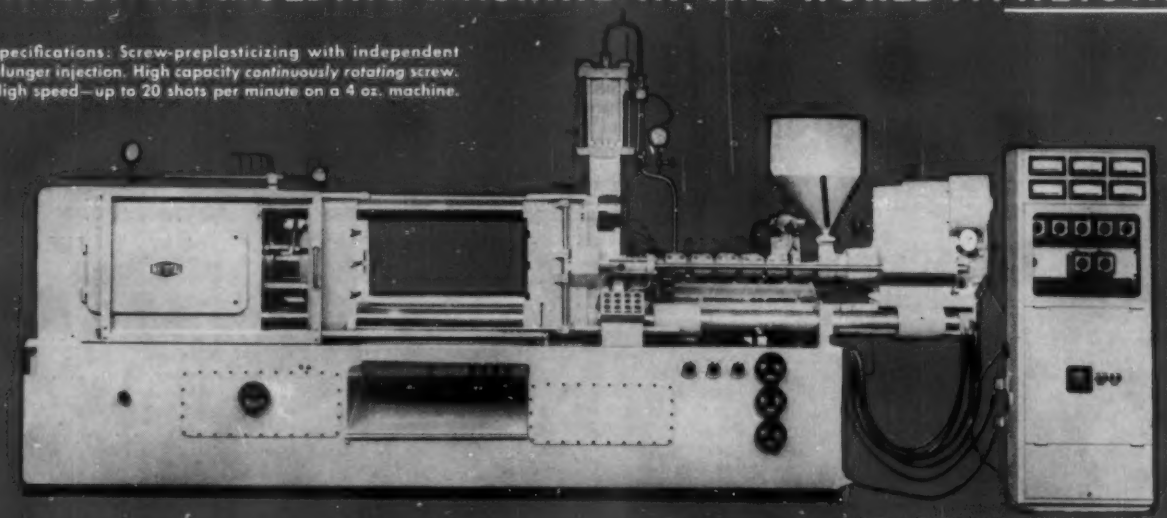

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